MEDDELELSER OM GRØNLAND

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UDGIVNE AF

KOMMISSIONEN FOR
LEDELSEN AF DE GEOLOGISKE OG GEOGRAFISKE
UNDERSØGELSER I GRØNLAND

BIND XLV

MED 46 TAVLER

KØBENHAVN
I KOMMISSION HOS C. A. REITZEL
BIANCO LUNOS BOGTRYKKERI
1912

DANMARK-EKSPEDITIONEN

TIL GRØNLANDS NORDØSTKYST 1906—1908

UNDER LEDELSE AF

L. MYLIUS-ERICHSEN

BIND V

INDHOLD

I.

THE TERRESTRIAL MAMMALS AND BIRDS OF NORTH-EAST GREENLAND

BIOLOGICAL OBSERVATIONS

BY

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WITH PL. I—VII

1910

INTRODUCTION

At the "Danmark Expedition" to the North-East coast of Greenland in the years 1906—08, planned and led by Mylius-Erichsen until his death, I was engaged as the ornithologist of the expedition. Considering that my observations would be undertaken chiefly on localities, affording likewise good opportunities for the examination of the terrestrial mammals of the country, I was requested later on by the leader of the expedition to take charge of this branch of zoology as well. Not without some hesitation I accepted the request, being less prepared for this work than I might desire.

Owing to the protracted stay of the expedition in the same part of the country and the relative limitation of my task, it may be said that favourable conditions for a good result existed beforehand. Nevertheless I did not ignore for a single moment that this result would depend to a great extent on continual cooperation with my travelling companions, and I am happy to attest that their readiness to help and interest for the cause proved greater than I dared expect. — Chiefly the faunistic notes from the sledge-travellers of the expedition have through the accuracy and intelligence, with which they are written, an extraordinary value for the knowledge of the extension of the birds and mammals in question beyond the rather restricted territory, on which my personal continual observations took place.

For this help I bring my companions my heartfelt thank!

Also for kind assistance from different parts during the revision of the home-brought material I owe sincere gratitude, especially to Messrs. Professor, Dr. phil. H. Jungersen and Vice-inspector H. Winge A. M.

The chief task of the "Danmark Expedition" was, as is well known, to chart the quite unknown stretch of coast fron the northernmost point reached by Koldewey on his sledge journey in 1870 — the tract round Cape Bismarck — to the terminal points for

Peary's expedition — Navy Cliff and the east coast of Peary Land. Moreover to the greatest extent possible scientifically to examine the climatic conditions of the country, its flora and fauna etc.

It was thus of the greatest importance to advance as far north as possible by ship, in order to form a favourable base for the coming north-going sledge journeys. The expedition was in so far fortunate. This particular summer the ice-hindrances were not too great to permit the ship's seeking winter harbour as far north as at Cape Bismarck — lat. 76°46′ n. — in "Danmarks Havn".

The arrival here took place on Aug. 17th 1906. For about two years the ship lay at anchor in Danmarks Havn which formed the starting point for the sledge journeys of the expedition. For my investigations which were necessarily bound mostly to the territory in the neighbourhood of the ship's harbour, the point reached was no less fortunate. I found here in the comparatively fertile, low coast country a strongly concentrated higher animal life which was surely richer than in any other tract visited by the expedition, with regard to species as well as to individuals. All the year round I had thus good opportunities, not only to make myself acquainted with the biology of the animal forms in question, but also to gather the zoological material necessary for working out the description later on.

An excellent supplement to my own systematic observations was rendered me — as above indicated — through the numerous sledge drives of the expedition. These journeys were undertaken nearly at all seasons — also in the dark time — to different parts of the coast country lying north of the ship's harbour. Also along the coast southward to Shannon Island and Sabine Island sledge drives were made several times, and in the spring 1908 examinations were undertaken by two different travelling parties on the inland ice and the large "nunataks", situated on the latter: "Dronning Louises Land".

From each journey I received zoological notes. In order to promote systematical investigations I always directed the attention of my travelling companions to the facts which eventually they would have the opportunity of observing, indicating precisely the informations which I might wish to obtain in the case in question. In this way I at length succeeded in procuring a material at the same time ample and reliable, to throw a light on the faunistic conditions of the country. Moreover some interesting observations of pure biological nature have come to hand by the same means. I shall just mention the pairing and breeding time of the polar bear, its means of support at different seasons etc.

While in the following I shall attempt to describe the appearance of the country in rough strokes, I shall not omit however to indicate the difficulties involved in this task, as the preparation of the chartographic material has not been finished as yet — a fact which has also caused me no small amount of trouble in working out the single articles.

From Cape Bismarck to Lamberts Land — lat. 79°10′ n. — the coast line is very broken, the coast being dissolved into a great many small islands and rocks. The greater part of the rather numerous inlets are not very significant and without particular ramifications. The rather large inlet "Skærfjorden" — lying between lat. 77° and 78° n. — the character of which is mostly that of a bay, is divided into several narrower and broader indentations, filled — as the name implies — with numerous rocky islands and crags. The vegetation here and especially at the southern arms of the inlet is comparatively luxuriant, and a great many traces of reindeer and musk-oxen were to be found everywhere. The bird life as well seemed richer than in any other place on this part of the coast.

With the exception of a few occurrences of sediment, the whole coast country consists in primitive rock moutonné. Some larger mountain plateaus are to be found nearer to the inland ice. Between lat. 78 and 79° n. ("Jøkelbugten") the inland ice advances nearly everywhere right down to the coast, from which it is continued unbroken to the range of islands lying outside the bay. Here it is lost in the sea ice which is supposed to be permanent in this place.

From Lamberts Land to "Nordost-Rundingen" — lat. 81°24′ n. — the character of the coast is changed conspicuously, the formations of skerries ceasing nearly altogether. The coast line which runs in north-easterly direction is broken only by a few rather deep and broad inlets. The geological conditions are here less uniform. From Lamberts Land to "Hovgaards Ø" an about 65 kilometer broad inlet is found, where the inland ice advances, and here as in Jøkelbugten it is smoothly merged into the sea ice which is probably permanent even here, the traveller not being able to decide with certainty, whether he is standing on the glacier or on the sea ice. The high island Hovgaards Ø is covered with névé fields nearly everywhere. On the principal part of the outer coast the glacier forms a steep slope, beyond which ice-calves are found. The sea ice was here broken on a long distance in the summer 1907. The travellers who passed the island in October the same year found still open water, reaching from the northeastern corner of the island to the mountain "Mallemukfjeldet".

Beyond the latter — lat. 80°13′ n. — the ice conditions are extremely different from the newly described part of the coast, lying more to the south. Even as early as in April the sledge travellers of the expedition found so much open water, that they were not able to pass without great difficulty. In June only the ice foot was left; otherwise the sea was perfectly free from ice. On October 16th even the ice foot had disappeared, and the waves were breaking against the naked rocks. These consisted of sedimentary layers about the height of 500 meter. The vegetation was here extremely scanty. On the eastern point of "Holms Land" which forms a very low tongue of land, a rather luxurious vegetation seems to exist on the contrary. Numerous remains of an Eskimo settlement prove that as well mammals as sea-birds have their resort here, a fact which the sledge travellers of the expedition had the opportunity of testifying moreover. In the case of the sea-birds it is doubtless the unusually favourable ice conditions which have such an alluring effect.

On this peninsula as well as on "Amdrups Land" which is situated north of the Ingolfs-Fjord, considerable sediment formations are found, on which a number of sea-birds have their breeding places. At the inner side of the inlet, in Amdrups Land, some parts are comparatively rich in vegetation. (Some musk-oxen were met with here.) The whole peninsula "Kronprins Christians Land" is covered with inland ice however.

On the west side of the newly discovered inlet "Danmarks Fjord", the travelling party of Mylius-Erichsen found a comparatively rich animal life. Several musk-oxen, arctic foxes, hares and an arctic wolf was seen. With regard to birds — as may be surmised from the diary left by Brønlund — it was especially ptarmigans and brent geese (*Anser torqvatus*) which the travellers met with in this place.

Judging from the map sketched by Hagen, the peninsula Mylius-Erichsens Land between Danmarks Fjord and "Hagens Fjord" forms for the rest a rather barren, undulating highland.

The south and east coast of Peary Land is formed by a flat gravel plain with some vegetation — in some places rather ample. Frederick E. Hyde Fjord, the northernmost inlet in the world, is rather narrow and deep, surrounded by high mountains, the summits of which reach a height of about 2000 meter. Chiefly the same animal forms as at Danmarks Fjord were observed here.

The rather large peninsula Germania Land which is bounded by Skærfjorden in the north and Dove Bugt in the south forms to-

wards the sea a perfectly barren and waste stone desert. The south coast — "Winges Kyst" — on the contrary is of great interest on the 60 kilometer long distance from the ship's harbour to "Rypefjeldet", as well with regard to vegetation as to animal life. It was in this tract that the expedition had etablished its different permanent stations of observation.

In the nearest environs of the ship's harbour as well as on the distance from "Stormkap" to "Snenæs" and further on the low, fertile plain surrounding the outlet of "Sælsøen" ("Lakseelven")[1], my systematic running observations were undertaken, just as the principal

Fig. 1. Maroussia. May 1907.

part of the collected zoological material originates from these places. My permanent summer station was established in the territory west of the mouth of "Stormelven". The adjoined ornithologic map comprises the territory from Stormelven towards Snenæs, so interesting with regard to ornithology, an area of 23 □ kilometer. (Concerning details about the quality of the territory refer to the above mentioned special map, surveyed in the days from June 28th—July 4th 1908).

With exception of the small island Maroussia and the sediment plateau on the east side of Store Koldewey Island, the numerous

[1] With regard to the names occurring in these parts of the country, the reader is requested to refer to the special map of the expedition.

large and small islands in Dove Bugt consisted of naked primitive rock.

Concerning the vegetation in the here described tracts it will be sufficient in the case of the present work to mention the botanical forms which lend their character to those localities that have some interest with regard to ornithology.

The regions, indicated on the map as "Rylekær", are boggy tracts which are to a great extent submerged in the proper time of snow-melting. The vegetation may be rather luxurious here, forming an almost unbroken carpet which consists chiefly in mosses, different cyperaceæ as *Carex* and *Eriophorum*, *Luzula* and a few grasses (*Poa*). Even some ranunculus were growing here, partly in the water (*R. altaicus*), partly on the irrigated shores (*R. glacialis*).

Fig. 2. Inundated fen scenery. July 1908.

The "Sandløberterrain" was characterized by *Salix arctica* and *Dryas octopetala*. Besides a more or less connected growth of *Cassiope* which was to be found especially on the lower parts that were covered with snow in the winter.

In the "Snespurveterrain" which consisted chiefly in somewhat higher lying grounds, covered with large blocks of stones, single or heaped together, rather important tufts of grass (*Hierochloa*, *Poa*)

were growing most frequently. Moreover *Potentilla, Cerastium, Papaver, Melandrium* and *Draba*.

The level, gravelly "Præstekraveterrain" was almost quite bare of vegetation. The same may be said of the gravel hills situated north of this territory, besides in different other places.

On the shores of the numerous, generally not very deep ponds and lakelets, some vegetation was found here and there, consisting chiefly in *Eriophorum* and *Carex*, besides *Pleuropogon* and *Hippuris* which were growing in a few places in the water.

Fig. 3. Saxifraga oppositifolia.

With regard to the general description of the vegetation of the country, the reader is requested to refer to the account of the botanist.

The climatic conditions — especially the ice currents — and the zoological phenomena in connexion herewith presented in the years 1907 and 1908 so great mutual differences as to make a joint treatment of these unpractical — on some points even quite misguiding. For this reason I prefer to mention each year separately, taking 1908 as the supposed normal year and using it as the base for some general remarks. What is wanting in 1908 may be supplied in all essentials with the autumn months of 1906, the two

years having resembled each other as near as possible judging from all appearances.

As an example of the temperature and downpour of the country in the different months of the year, the following tables may be stated[1].

Average temperature	1906	1907	1908
January		÷ 23·0	÷ 20·7
February		÷ 25·9	÷ 28·8
March		÷ 23·4	÷ 20·9
April		÷ 19·0	÷ 19·2
May		÷ 7·9	÷ 6·1
June		+ 1·4	+ 1·3
July		+ 3·6	
August		+ 2·6	
September	÷ 3·3	÷ 4·0	
October	÷ 14·0	÷ 14·3	
November	÷ 21·2	÷ 19·6	
December	÷ 24·5	÷ 17·1	

The winter 1906—07		1907—08	
November—January	÷ 22·9	November—January	÷ 19·1
February—April	÷ 22·8	February—April	÷ 23·0

Downpour	1906—07	1907—08
	mm.	mm.
August	0	16·1
September	5·7	8·9
October	10·7	2·2
November	13·6	38·3
December	20·3	17·4
January	27·0	33·9
February	23·5	11·5
March	23·1	12·5
April	4·3	0·8
May	2·6	5·0
June	10·2	0·6
July	1·8	0·0
	142·8	147·2

The first month of the year belongs completely to the cold, the darkness and the waste of winter. Violent and sometimes continuous snowstorms are followed by clear, calm air with very low temperature — until about ÷ 40°. The birds — with the exception perhaps of a single snowy owl — have left these inclement regions long ago, while the mammals which are bound to the soil, lead a more or less miserable existence.

[1] The designations of temperature are all according to CELSIUS.

Worst situated are doubtless the foxes and wolves; the conditions of life of these animals seem to me incredibly hard. As regards the two other carnivorous animals living in the country, the polar bear and the ermine, the conditions are here somewhat more favourable. To be sure the bear is reduced to live by chance as well as the foxes and wolves, but its capacity as a seal-hunter, combined with the fact that it is able to range about on the sea ice, where it may hope to find a little open water here and there at all times of the year, gives the bear augmented possibilities of acquiring booty. The hunting ground of the ermine is in this time exclusively confined to the lemming passages under the snug snow-drifts. Here the small, comparatively thinly coated beast of prey finds at the same time protection against the cold and as a rule ample food.

On the mountain slopes which have been swept clean by the storm and in other snowless places the musk-ox and polar hare seek their modest living. Even under circumstances where the snow covers the ground loosely, these animals are able to make their way to the plants which form their means of support. Crusty snow which may be extremely inconvenient to the herbivorous animals, present no obstacle to them as yet. — In this period the life of the lemming, as that of the ermine, is entirely confined to hidden places. In the numerous passages between the surface of the ground and the thick layers of snow, the easily contented little rodent animal finds so ample food that — as far as I was able to ascertain — it did not hesitate to breed in the very heart of winter.

As is shown by the affixed tables the average temperature of February was rather lower and the downpour somewhat less ample than in January. About the middle of February the sun rises over the horizon. The effects of the returning light might be traced even in the first days of the month, as the two hardy birds, the ptarmigan and the raven, made their entry about a week before the sun. These two bird species, the migrations of which towards the south do not reach very far probably, at any rate not beyond the boundaries of the country, did not seem in the least inconvenienced by the low temperature, and decidedly their departure from these regions must be due only to the darkness. In the case of the ptarmigans only a few small flocks, nearly all males — were seen in the first half of February.

Though no snowy owl was seen in February, I believe that the species appears already in this month. Judging from observations made I suppose — as before indicated — that single individuals are able even to winter in the country. In the case of certain mammals, chiefly polar hares and musk-oxen, the cessation of the period

of absolute darkness brings perhaps a little alleviation in their circumstances, just as the fox with the arrival of the ptarmigans has got a chance more. For the rest the conditions of life are very nearly the same in the two months with regard to the higher animal forms living in the country.

The climatic conditions of March are like those of the two preceding winter months. On account of continual low temperature the increasing sunlight has no particular influence on the character of the landscape. Towards the end of the month a faint evaporation of the snow masses may be traced however. — Ptarmigans, ravens and snowy owls are still the only birds which the traveller finds on his way. Enticed by the sunlight the ermine and lemming begin to make small excursions on the surface of the snow, though still they resort chiefly to the hidden places on account of the severe cold. In March the pairing of the arctic fox, and probably of the ermine as well, takes place.

Though the average temperature of April was ÷ 19, still this month made in some respects an impression of spring. The downpour was extremely insignificant, and the increasing sunlight caused a perceptible evaporation of the snow on the southward facing slopes, on the flat shores and in the meadow lands. Any snowmelting proper was consequently out of the question as yet. The inlet ice as well as the icecovered freshwater lakes and streamlets on land still retained the character of winter entirely.

In the beginning of April the first snow-buntings arrived, exclusively old males. The ptarmigans and snow-buntings were always seen seeking their food on the snowless spots, especially near the coast and in the low-lying fens. Towards the end of April the paired gyrfalcons were seen at their nests.

According to the observations of Koch and Bertelsen the storm petrels (*Fulmarus glacialis*) had arrived already in April in great numbers at their nesting places on "Mallemukfjeldet". The unusually favourable ice conditions which always exist here, as far as the travellers were able to judge, consequently account for the early arrival of the species.

The polar hares which begin to pair in April, assembled in parties on the most favourable foraging localities, and traces of ermine and lemming were now frequently to be found — in the case of the latter even often on the inlet ice. The polar bear, the pairing of which also partly takes places in April, began to hunt the seals which were lying on the inlet ice now and then, at the edge of their breathing holes, enjoying the warmth of the sun.

The month of May forms the transition from winter to summer,

even though the weather may still be very capricious. Calm air with splendid sunshine alternates with cloudy weather, cold mists and violent local showers. When I was camping out in tent on Stormkap during the last days of May 1908, I thus experienced a two days snow-storm of such a severe character that it was impossible for me to venture out of the tent, while the storm lasted. After the cessation of the storm the snow-buntings appeared, having assembled in large flocks, quite exhausted with hunger, and several perished individuals were to be found all round the territory. The

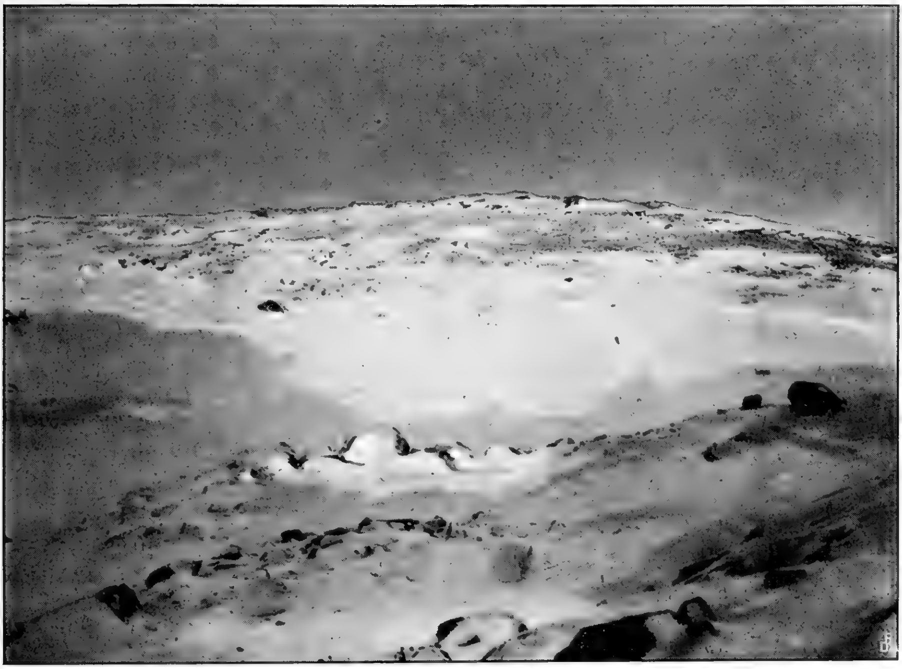

Fig. 4. Polar hare locality (below two hares). April 1907. ("Harefjeldet").

new fallen, thick layer of snow disappeared with an astonishing haste for the ensuing sunny warmth, and several insignificant pools of melt water appeared in this way in the low-lying fens and meadow lands.

The evaporation of the snow takes place at a furious rate, especially towards the end of the month, and melting from below may be traced here and there, though the mean temperature is still rather low (÷ 6—7°). In some places on the inlet ice open tide water cracks were formed, especially along the coast. The ice on the freshwater lakes and streamlets remained unbroken all the month.

The vegetation began to get alive on such localities which were particularly exposed to light and warmth.

The sea-gulls (*Larus glaucus*) which have arrived about the middle of May, seek their food especially in the above mentioned tide water cracks. Thanks to their high soaring and sharp sight the sea-gulls also quickly found their way to seal carcasses and the like food, just as they are seen frequently at this season intruding on the hunting polar bear.

The barnacle goose (*Bernicla leucopsis*) arrives in the last half of the month and immediately seeks the snowless, richly grown spots in the interior of the country. The ptarmigans are seen in pairs, and in fine weather the male snow-buntings which have changed colour, merrily sing outside the nesting places. Large flocks of snow-buntings which have not quite got their summer plumage are strolling about in the fens and along the sunny mountain slopes. In rough weather the birds which have already paired, join these flocks. The gyrfalcon already breeds in May, and as far as I was able to judge, the raven has young ones. On one of the very last days of the month in 1908 all the small waders arrived — with exception of *Phalaropus fulicarius* which makes its appearance somewhat later — and through their merry melodies and restless stirring about they at once gave the landscape a wonderfully cheering character. Directly after their arrival the small waders sought their food exclusively on the snowless spots in the interior. At this time I never saw them quite near the coast, no chance of acquiring any food being offered them here moreover. While *Ægialitis hiaticula* and to a certain extent *Tringa canutus*, *Calidris arenaria* and *Strepsilas interpres* generally sought stony and sandy, bare spots in the neighbourhood of bogs and fens, *Tringa alpina* was nearly always to be found near those moist parts of the bog itself which had been produced by the warmth of the sun or by irrigation of a little melt water. During snow-squalls, in mist or strong wind the waders always assembled, strolling round in the territory in a state of hunger and misery, often in company with large flocks of snow-buntings.

In the first days after the arrival of the small waders, a principal part of their food was made up by the fruits and seed of last year's plants which protruded above the snow. Green germs and half developed leaves I also found in the stomachs of the wading-birds which I examined.

A single *Lestris longicauda* might appear towards the end of May, and immediately it began the pursuit of lemmings on the old, well-known localities.

In the first week of June the snow melting was obvious nearly everywhere. Like an outspread panther hide the territory near

Stormkap disclosed itself to my eyes. The dark spots were now rather numerous everywhere, but never of large extension. For some days the snow was still prevalent. Towards the middle of the month the melt water began to trickle down the mountain slopes in earnest, forming large ponds and pools in the lower lying meadow grounds. Along the shores of the shallow freshwater lakes the ice thawed away, and on the moist sand or mire the small waders now found ample food. During the first half of the month *Lestris longicauda* had arrived in great numbers, just as the rest of the bird species which breed in the country, made their entry. *Colymbus septentrionalis* filled the air with its wide-sounding cackle,

Fig. 5. What waders have to face when they first arrive. Stormkap June 3th 1908.

and in the ponds *Pagonetta glacialis* and *Somateria spectabilis* were lying in pairs or in smaller flocks. The pretty little *Phalaropus fulicarius* resorted in pairs to the richly grown shores of the lakes or the melt water ponds in the fen territory proper. In and near the open cracks on the inlet ice *Somateria mollissima* and *Sterna macrura* were seen. The *Anser torqvatus* which goes higher north was seen now and then resting on grassy shores of lakes and on the meadows.

In the last half of June the murmuring and rushing of the rivers was heard all round the territory.

The afflux of melt water was in the very last days of June so enormous that at the mouths of the more important water courses the inlet ice was broken on long distances. In this way the range of food-seeking was extended very much in the case of certain swimmers — *Somateria mollissima, Larus glaucus* and *Sterna macrura.* Also *Colymbus septentrionalis* left the freshwater lakes at

Fig. 6. Near the outlet of Stormelv. July 1907.

Fig. 7. River scene. July 1908.

certain times of the day and resorted to the outlets of the rivers in order to fish. Only *S. spectabilis* and *Pagonetta glacialis* always kept to the small freshwater lakes and ponds on land.

The ice on the bays and inlets lay unbroken all the month however; only it had changed character to a certain extent, as it was strongly furrowed by open cracks in many places towards the end of the month.

Before the end of the month most of the freshwater lakes were

Fig. 8. Summer landscape from Stormkap. July 1907.

completely free from ice. A few larger, deep mountain lakes in the interior of the country lay covered with ice all the year round.

Caused by the strong afflux of melt water large stretches of fen were often quite or partly submerged, on which occasion several nests of *Tringa alpina* were lost. The wading-birds and skuas were now taken up with brooding.

In the first week of July the summer was on its height. The country was then in most places quite free from snow, and at no time of the day or night the temperature was so low that it acted injuriously on plant and animal life to any marked extent. The scant, but on the other hand extremely graceful flora was perfectly developed and gave in connexion with the by no means insignificant

insect life the otherwise so waste and severe surroundings a strangely cheerful, summer-like appearance. The swimmers — loons, eider ducks (both *mollissima* and *spectabilis*) longtailed ducks and terns — began brooding in the first half of the month. At this time the young snow-buntings left the nests without being quite ready to fly as yet. From the blocks of stone on which they took their seat, their continual, monotonous chirping was heard day and night, while the parents brought them food. — Small parties of *Tringa canutus, Calidris arenaria* and *Strepsilas interpres* ran about screeching on

Fig. 9. Scene from "Bjergandesø". July 1907.

the mountain plains and near the shores of the freshwater lakes seeking food which consisted almost exclusively of insects and larves at this time of the year. Not rarely did I meet with such flocks of waders at the border of the few remaining snow-drifts, the melting of which now took place at such a furious rate that large areas lying below were quite inundated. As far as I was able to judge, it was especially fine parts of plants (*algæ*) which the birds were seeking here. — About the middle of July these roving flocks of waders which had increased in number daily, left the country. According to my investigations the flocks were chiefly made up of males, — their share in hatching the young ones being now finished, — besides a few females, the brood of which had been lost in some

way. Also some specimens of old birds (both sexes) without indication of brooding speck did I find among the flocks.

Most of the male eider ducks, especially those belonging to the species *spectabilis*, disappeared likewise in the middle of July; some individuals even earlier. After the middle of the month I saw everywhere on the plains and moors the downy young of the waders. They lived exclusively on animal food, especially flies and gnats and the larves of these insects which were present in immense numbers.

That the summer time with its mild weather and abundance

Fig. 10. Small freshwater lake. Favourite breeding place of Redthroated Divers.

of food brought an extremely pleasant change from the severe conditions of the winter in the case of the mammals, may be easily understood. While the polar bear and musk-ox also in the summer were strolling about far and wide, accompanied by their young, the foxes, wolves and hares led a less roving life, and in the case of the two last mentioned animals they were most frequently to be found near the place where the young were staying.

Already about the middle of August the summer was evidently declining. At times the night-frost might be rather perceptible, and now and then it caused a formation of thin new ice on the sea-

water which had otherwise become ice-free in most places during the month of July. Still the formation of new ice was never of long duration as yet, and often it disappeared in the course of a few hours. — The sun which was still always over the horizon exerted a rather considerable, softening influence on the approaching autumn, and as a rule the effects of a single local snow-squall were without much importance with regard to the bird life.

The comparatively sensitive young wading-birds were now nearly all able to fly and consequently much better equipped to meet the cold night air or a passing storm. Young *Calidris arenaria, Strepsilas interpres, Ægialitis hiaticula* and to a certain extent *Tringa canutus* assembled in flocks on the shores of the inlets, where they fed especially on smaller crustacea and worms, while the old parent birds flew away immediately, when their mission concerning the care of the young had been fulfilled. Only *Tringa alpina* left the country in families.

Quite small, downy eider ducks and longtailed ducks were still seen at the mouths of the rivers or farther out on the sea-water. With incredible hardiness these tiny creatures braved the cold and the rough weather, just as staying in the icy water did not seem to inconvenience them in the least.

Sterna macrura and *Lestris longicauda* had their young fledged in the middle of August, but were still seen bringing their offspring food for a few days more.

At the end of August the night-frost increased considerably and closed the pantries of the wading-birds, ice being formed along the shores of the inlets and on the freshwater ponds with shallow water.

The insect- and vegetable life died away, and the remaining young waders flew southward with the exception of a few stragglers. The same was the case with the skuas and barnacle geese. The terns had left the country about a week earlier.

In September the average temperature, as shown by the table, had again become negative. In the beginning of the month all the freshwater lakes lay covered with ice. With very few exceptions the rivers were dried up long ago, and the few remaining stragglers of wading-birds — late developed or sick individuals — led a miserable existence on the frozen shores, ending in most cases as an easy prey to the gyrfalcon, the autumn passage of these birds being now on its height. Large crowds of snow-buntings were strolling about on the plains, especially along the coast, where also some few smaller flocks of ptarmigans appeared now and then, having left their summer residence on the mountains in the interior of the country. On the bays and inlets the open water still prevailed, and here I daily

saw some sea-gulls (*Larus glaucus*) — old birds accompanied by their newly fledged young ones. Small flocks of young eider ducks and longtailed ducks I also met with here. The loons flew away already in the beginning of the month.

In the end of September open water was almost nowhere to be found, and the last sea-birds left the country — evidently most unwillingly. The passage of the falcon ceased and was to a certain extent succeeded by that of the snowy owl. Besides a few small flocks of snow-buntings, some ptarmigans and ravens comprised the rest of the rich bird life of the summer.

The hair change of the polar hare and arctic fox was finished and their young had very nearly grown up. The ermine had changed its brown summer dress for the white winter coat. The lemming which had likewise donned its winter dress, was now more rarely seen on snowless ground, but generally it resorted to places where the first autumn snow had been heaped up in thick layers.

With October winter again made its entry, bringing severe cold and some snow-storms. In the first days of the month I still might meet with a single, sadly chirruping snow-bunting on my wanderings. Soon even that had disappeared; only the ptarmigans, ravens and snowy owls were able to hold out with the sun. One of the very last days of October the latter took its leave, and the last birds fled with the light.

While the cold in November became more and more perceptible, the downpour was considerably augmented. This last circumstance was, as before mentioned, of the greatest importance to the two mammals which had the least power of resistance against the cold: the lemming and the ermine. Under the large snow masses the animals found a natural protection against the protracted cold of winter. With regard to the other mammals living in the country the conditions of life in November and December were very nearly the same as mentioned under January.

The observations about terrestrial mammals and birds which I had the opportunity of making in the year 1907 — compared with my experiences from the after-summer 1906 and the summer 1908 — seem to prove that the winter 1906—07 must have been unusually unfavourable to several higher animal forms, especially such, in the case of which a not too low temperature, an ample autumn downpour or a normal ice-breaking play an important part.

An animal which attracted my attention to an extraordinary extent through its varying appearance was the lemming (*Myodes*

torqvatus.) In the after-summer — August and September 1906 — I found everywhere on my wanderings unmistakable signs of the presence of innumerable lemmings, just as I had the opportunity of seeing every day numerous representatives of the animal forms, to which the lemming is as it were a condition of life, viz: the arctic fox, the ermine, the snowy owl, the gyrfalcon, the raven and the skua (*Lestris longicauda.*) The numerous examinations of the stomachs of such lemming hunters which were undertaken, proved moreover that the chase had been extremely rich, and that the animals in question had been living almost exclusively on lemmings. In this connexion I may mention that the partakers of the expedition almost daily caught or saw lemmings, which also appeared in great numbers at the excavations which were undertaken of old Eskimo dwelling places.

If it was thus a fact that the country was richly populated with lemmings during the expedition's first sojourn here, the negative results which my continual investigations about the species brought me in the coming year, might convey the idea of abnormal climatic conditions being the cause of the phenomenon.

In April and May 1907 I always had my attention directed to the lemming during my daily excursions. I often visited the places, of which I knew with certainty that formerly they had harboured an especially great number of individuals, but only in exceptional cases I found a single lemming trace on the snow. Gradually as the latter evaporated or melted away, by which means large, hitherto not examined distances were bared, I certainly found plenty of lemming holes, but at closer inspection they all showed distinctly enough that they had been uninhabited for a long time. Without entering into the biology of the lemming on this occasion, I must still indicate that the animal by no means leads a passive existence, hybernating or living on a saved-up winter store, but is astir all the year round in search of food. In the winter, when the snow lies deep and comparatively smooth, the lemming resorts by preference to the surface of the ground, along which it makes its way in all directions to the plants which constitute its food. The thick, isolating layer of snow renders the animal the necessary protection against the cold. (See: more about this under the article *Myodes torqvatus.*) A winter, the first months of which bring a small amount of downpour and frequent storms which immediately lash away the snow from disproportionately large areas, in connexion with extremely low temperature, must thus prove fatal to the lemming[1].

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[1] See: the table about downpour and temperature.

The latter will be entirely or partly ruined on the large, snowless distances, and only on localities which are at the same time provided with a thick layer of snow which has drifted together, and sufficiently rich vegetation, it will be able to sustain life. The few signs of lemming life which my investigations in the spring 1907 brought me, were thus bound exclusively to localities fulfilling those two conditions; but such places were very rare and must be sought especially on mountain slopes and in hollows on the top of the mountain itself. On the richly grown meadows and plains, as for instance the plain between Hvalrosodden and Rypefjeldet, where the lemming had appeared especially numerous in the preceding after-summer the ground was almost perfectly free from snow all winter, and even if a small spot of snow was to be found here and there, the layer of snow on such places was far from sufficiently thick to render the animal the necessary protection against the severe cold. — My not few attempts of excavation in the summer 1907 were positively all in vain. I only found empty lemming burrows and deserted nests even in places where, in consequence of former experiences, I might expect to meet with a particularly rich lemming life. Indirect proofs of this strikingly great reduction of the lemming stock were rendered most conspicuously through the before mentioned enemies of the lemming. Already in the early spring foxes and ravens sought other means of livelihood and were seen most frequently along the coast or on the ice, trying by the open holes and crevices to seize upon the here occurring lower animals. In quite exceptional cases I saw a fox in pursuit of lemmings. Snowy owls and falcons sparingly appeared on the passage, and the skua, the breeding conditions of which depend completely in these regions on a tolerably normal lemming life, did not breed at all this summer.

The great multitude of lemmings presented by the after-summer 1906, might seem to indicate that several successive favourable years have gone before and that winters like that in 1906—07, are rather unfrequent.

In the summer 1908 I might again meet with the lemming in most of the tracts which I examined, but nowhere in anything like the number which was seen in 1906. As far as I was able to observe, the lemmings multiply very strongly under normal conditions. For this reason it seems most likely that ihe increase of individuals after an unfavourable year like 1907 is effected chiefly through the brood of the surviving, stationary animals, even if also — what much might seem to indicate[1], an immigration takes place

[1] See the article about *Myodes torqvatus* — the traces on the ice.

of animals going out from places, where the conditions have been less unfavourable, the snowfall having been more important and the storms less frequent. Such deviating climatic conditions might be traced plainly in 1907 on the islands lying about 70 kilometer to the south of Stormkap, in the neighbourhood of Teufelkap.

I shall hereafter shortly mention some observations concerning the birds, the breeding of which was partly or entirely dependent on a normal ice-breaking, viz: both eider duck species, the long-tailed duck, the large sea-gull (*Larus glaucus*) and the tern (*Sterna macrura*). Of all the species here mentioned I found in August 1906 young ones in relatively large numbers. On the whole I had the impression that in this particular summer all these sea-birds were doing well, finding ample food and good breeding conditions. Open water was to be found everywhere. The exact time for the disappearance of the ice cannot of course be fixed with any certainty, but it seems to me most probable that already in the beginning of July — as in the summer 1908 — the birds will have found some open water, in consequence of which they don't hesitate to build their nests.

At the arrival of the here mentioned species in June 1907, the ice lay everywhere quite unbroken on bays and inlets, being more than 1 meter thick. Along the shore a single narrow tide water crevice might be found here and there, but pools of melt water and small openings which are otherwise common on the sea at this time of the year, were sought for in vain by the birds. King-eiders longtailed ducks, sea-gulls and terns found sufficient food however in the partly open freshwater lakes on the mainland. Only the common eider duck resorted as usual almost exclusively to the above mentioned, sparingly occurring tide water crevices which were also frequented now and then by terns and sea-gulls.

The number of the arrived breeding birds corresponded exactly to that on which I had reckoned, judging from my experiences of 1906. On the contrary the young, one and two years old sea-gulls which had been so common the preceding summer, were now entirely wanting.

The king-eiders were still staying in pairs in the lakes, till the males flew away towards the end of June. Normally the brooding time of the females was at hand, but no signs of open sea water appearing as yet, the birds assembled in small flocks instead of building their nests, roving about for some days in the fresh waters and leaving the country at last altogether, without having hatched a single brood of young ones. The same was the case with the

species *mollissima*. In shot females of both species I found only quite undeveloped eggs in the ovary.

The terns visited their old nesting places in crowds several times daily, staying here a few moments at a time, only to disappear again to their foraging places in the ice crevices or the freshwater lakes. Here and there they left a few loosely dropped eggs on the nesting places, but not a single young was hatched this summer. Much earlier than ordinarily the terns disappeared altogether. Neither the longtailed ducks had any young ones. One single brood of two indididuals I met with, however, on the shores of Lakseelven which was free from ice all summer, while the little bay lying outside the river was covered with ice nearly all the time. A few pairs of sea-gulls, the nests of which had probably been laid in the mountains west of the Lakselv, appeared towards the end of August, bringing with them their grown-up young, to which they must have found sufficient food in the large, salmon-filled river.

(A more explicit account of the breeding conditions of these bird species will be found in the respective articles.)

Remembering with what obstinacy nearly all birds will resort to the once chosen breeding places, one will not be surprised to find that the birds on the here mentioned territory appear at the normal time and in the normal number, without regard to the weather and the ice conditions, and when the circumstances are considered too unfavourable, they fail to breed, instead of taking themselves off quickly to places offering better opportunities, though this perhaps might seem more likely to happen. The birds know well enough that such places, even if they fulfilled the desired conditions, will be populated in advance on a suitable scale, and consequently the here domiciliated birds of the same species will defend their domain energetically.

List of
the terrestrial mammals of North-East Greenland.

1. Lepus variabilis var. glacialis.
2. Myodes torqvatus.
3. Canis lagopus.
4. Canis lupus.
5. Ursus maritimus.
6. Mustela erminea.
7. Ovibos moschatus.
8. (Rangifer tarandus.)

The Alpine Hare. *Lepus variabilis* Pall. var. *glacialis* Leach.

This species may — according to existing reports — be considered of comparatively scarce occurrence on the east coast of Greenland, south of 76° lat.

(A concise account of these reports is given in H. Winge's: Grønlands Pattedyr. — Meddelelser om Grønland, Vol. 21, 2nd division.)

The alpine hare proved to be very common in the regions which were explored by the "Danmark Expedition"; at certain places it occurred indeed so abundantly that it became of economical value for the expedition.

Besides the considerable number of hares, which were shot and eaten during the sledge-voyages, not less than some 400 hares were brought home and consumed on board the ship during the two years it was bound in the ship's-harbour, in the very neighbourhood of which nearly half part of them was secured. The two small fell-regions "Thermometerfjeldet" and "Harefjeldet", which are lying close to the ship's-harbour, were almost always inhabited by rather many hares, and at certain seasons it was by no means seldom to meet with flocks containing 10 to 15 individuals. Other places in which the alpine hare occurred abundantly were the country near "Hvalrosodden" (especially "Rypefjeldet", "Trekroner" and "Moskusokse-

fjeldene"), "Koldewey-Islands", "Nordre Orienteringsø" and the "Snenæs" territory.

The alpine hare — or traces of its existence — were found as well along the shore as far from the coast, when but tolerable localities were at hand.

The members of a sledge-journey — LINDHARD, WEGENER and WEINSCHENCK — observed and secured hares during their trip to the inland ice, as well at the edge of this, as at "Dronning Louises Land", 40 kilometers from the shore.

Another travelling party visited this locality in May 1908 and found — according to KOCH's account — hare traces everywhere; at one place (along the edge of the inland ice west of "Annekssøen") the hares had made real paths in the snow. Even on the small rocky islands farthest out at sea as for instance Maroussia and the outer skerries I found traces of the hare, showing that they reach these places over the ice; a hare was shot on Maroussia February the 27th 1908.

The following notes concerning the existence of this species are taken on the expedition's sledge-voyages farther north.

November, the 24th 1907. "At the east point of Lamberts Land we saw fresh hare foot prints leading from the continent towards the islands." (LINDHARD.)

April, the 29th 1907 lat. 80°45′ n. ("Amdrups Land"). "Upon a table-land, elevated some 100 meter over the surface of the sea, and near the coast, we shot 5 hares. The vegetation rather vigorous." (G. THOSTRUP.)

April, the 1st 1907. "We advanced the distance from "Nordre Depot" to "Lamberts Land" lat. $78^1/_2$°—79° n. over the ice between islands near the coast; no signs of living animals were noticed here. Mylius-Erichsen and the eskimoes went ashore and up country to shoot, and they got here 7 hares. High mountains (near Pic de Gerlache)." (BERTELSEN.)

April, the 11th 1907. Lamberts Land lat. 78°8′ n. "Many hare traces all over the territory. We secured 1 hare." (KOCH & BERTELSEN).

May, the 18th 1907 lat. 83°10′ n. (Fr. E. Hyde Fjord.) "GABRIELSEN secured here 4 hares. The vegetation relatively luxuriant: *Dryas, Salix* & thin grasses." (KOCH.)

In a letter from MYLIUS-ERICHSEN dated May the 28th 1907 is said: "At "Danmarks Fjord" lat. 81° n. long. 29° w. we shot 22 hares."

According to Brønlund's posthumous diary it is evident, that the alpine hare occurred rather commonly in "Mylius-Erichsens Land", presumably especially along the western coast of "Danmarks Fjord".

This species was incredibly fearless in almost any season of the year and occurred so very commonly in many of the places, which I came over during my relatively long stay in the country, that I succeeded in becoming very closely acquainted with this beautiful and extremely interesting inhabitant of the arctics; the study of its ways and habits gave me great pleasure.

Fig. 11. Favorite hare locality. April 1908. (Thermometerfjeldet.)

The alpine hare is decidedly a rock dweller and is almost constantly to be found in the close neighbourhood of or upon the very mountain, on the slopes of which it especially finds its food.

The hare also rests and sleeps on the slopes, but in danger it takes refuge to the upper regions of the mountain.

Only in the severest time of winter, when it is sometimes difficult to the hare to find its food, it ventures to leave its real territory and emigrates to the lower shore-plains, the meadows and marshes partly free from snow. Here it can feed, but in case of danger or if it wants to rest it returns as a rule to the nearest slope or larger stone-hill. The before mentioned migrations over the ice

to and from the skerries are nearly exclusively undertaken in the hardest time of winter.

The alpine hare prefers to live on rather low slopes strown with stones and with scanty vegetation. Such slopes are preferred, that give the hare in case of danger easy access to more elevated regions.

Though not exactly a nocturnal animal the hare always takes the hours of rest at that time of the day, when the sun is at its highest. Yet it will begin a meal even in the middle of the day if it is wakened up or frightened.

Fig. 12. Favorite hare locality. March 1908. (Harefjeldet.)

In the dark period it seems to have no fixed time of rest.

When resting the hare generally sits near a large stone or a low wall of rock, dozing or asleep sheltered for the wind and if possible warmed by the sun. Most commonly it will choose its seat a little way up a slope not too near the top nor at the foot.

Through large not too hard snow drifts formed in winter the hare will sometimes dig long channels for shelter; but as a rule I found it even in the severest winter cold sitting by its stone without any other shelter, than what the stone could afford and with only that deepening in the snow, which was caused by the weight of the animal.

The hare keeps quite immovable during its resting time sitting

Fig. 13. Alpine hare. April 1907.

Fig. 14. Alpine hare. April 1908.

crouched with the ears half erected, seldom turned quite backwards and the eyes nearly closed; surrounded by snow, as it is, it is therefore extremely difficult to discover even at quite a short distance.

I often found 2, 3 or 4 hares crouched together in such attitudes.

I caused the animals to rush up, when I suddenly made noise or quickly moved my hand or foot.

In rapid jumps they hurried up the hill side — never the opposite way — moving on the tip toes of the hind limbs, while the fore limbs either dangled in the air or were kept close to the breast.

The vigilant animals danced among each other — still without using their fore limbs — looking out for the nature of the danger, while they turned their ears forward and strongly scented by means of their nostrils.

Not the weakest vibration in the air did under these circumstances escape the attention of the animals.

Fig. 15. Alpine hare, stretching himself after sleep.

I feel sure, that the hare in dangers more trust their sense of hearing and smelling than their sight.

I convinced myself at many other occasions, that the hare's sight is not very strong.

If the frightened hares considered the danger to be only slight — as they for instance did when I kept quiet — they soon give up their "playing kangaroos" and would slowly on all fours jump towards the nearest larger stone to continue their broken off repose; on the way they would occasionally snatch a mouthful of alpine willows or other eatable plants.

If they found the danger threatening, they would — using all four limbs — go for the top of the fell in a wild run; among the highest rocks they would sit for a moment and keep a look-out only to disappear all together the next instant.

Solitary sitting hares suddenly frightened would execute the very same kangaroo-like movements, which the animals also accomplished when — looking for food — they were suddenly surprised.

If from an ambush I shot a hare out of a flock of grazing animals, the others would dance around for a few seconds until they felt convinced, that the case could not be dangerous; then they would again begin to look for food while their shot — sometimes still sprawling — companion was lying amongst them.

When in the afternoon the hare begins to feel hunger it slowly leaves its resting place after a violent yawning and stretching of the limbs; the hungry hare makes a few indolent jumps forwards on

the hill side and then begins to snuff and scrape for food. This consists essentially of the subterranean juicy stalks and roots of *Salix arctica,* which the hare highly appreciates. The animal may therefore often be seen busy getting this food, when the earth is thawed up.

I have often at a distance of but a few paces witnessed this interesting work. The hare selects by means of the nose the most promising place and then goes to work scratching away the upper layer of earth using its fore limbs with a surprising skill and

Fig. 16. Alpine hares. April 1907.

vigour; thereupon it makes its way — by means of its nose — to the desired delicacy which it triumphantly hauls up sometimes in pieces of some 20—30 cm. length.

Now the hare sits with a dignified air and half closed eyes — evidently envied by its surrounding companions — enjoying the juicy meal, the longmoulted willow root still hanging out of the mouth like a cigar.

The energetic masticating motions could distinctly be heard like a weak rustling. Soon the last rest of the willow root disappears and the hare again begins to search and snuff, but first it removes the dirt from its muzzle either by aid of the fore paws, or by rubbing it against the turf or a clump of snow.

The hare especially searches for this kind of food in moisty places as for instance in certain mountain clefts, covered with turfy ground.

The alpine hare also likes to eat the upper parts of *Salix* as well as *Saxifraga* and a few other mountain plants.

When in winter there is a want of other food, it must be content with moss and withered grass.

One captured alpine hare, which I brought on board the vessel, ate immediately and without any sign of fear those willow roots and twigs, which I handed it. It also ate white bread, but refused most part of those plants, which I carried home for it; only *Salix* and *Saxifraga oppositifolia* were accepted by the animal.

Crusted snow, through which the hare is not able to penetrate with the fore legs or the nose in usual way, is forced in the following manner: Having first — by aid of its surprising sharp sense of smell — assured itself where the food can be found, the hare hammers its fore limbs against the snow crust in rapid strong beatings until the crust breaks all over. The animal can then by aid of its nose and nails remove the subjacent loose snow and get at the desired food.

I have also seen hares, which, having drummed through the icy snow crust, remove larger pieces of broken ice by means of the mouth in order to make better room to go on with their work.

The peculiar sound, which the hare produces by the said beating or drumming against the snow crust reminds you of distant rolls.

Characteristic to the alpine hare is its pronounced tendency for sociability.

Though this social propensity never quite disappears, it will be less evident in summer — June & July — when the fells are quite bare of snow, and the white animals fully deprived of their natural protection. The hares showed at this season a remarkable fear of human approach, and sometimes they were so shy, that one could not get them within rifle range.

In the pairing time — April and the first days of May — quite the opposite is the case.

The hares assembled in greater parties containing some 15 to 20 individuals, and they proved so confident, that they — by a proper mode of proceeding — could be treated just as tame animals.

Thus I could every day — on the before-named "Harefjeld" in the neighbourhood of the ship's-harbour — go among the hares as among a flock of pigs; I could touch them with the tips of my fingers, get them to eat a willow root, which I held out to them,

catch them in a catcher, let them loose again after having kept them in my hands, catch them again a. s. f. all provided, that I did not frighten the animals or make them uneasy by my arrival or by a sudden noise or quick movement. While the hares were searching for food on the side of the fell or in the more luxuriant ravines, they executed the funniest plays. Sometimes one pursued another a long way on the fell until the pursued hare at last performing a high jump dropped down just behind the pursuer and then hastened back to the flock; sometimes the grazing animals would sneer at each other and lay the ears backwards just as snappish horses. At one place male and female were sitting licking and scratching each other with their fore paws until they were disturbed by their companions, which were sitting or jumping around. The hares slake their thirst by taking a mouthfull of snow now and then. The hares free themselves from loose tufts of hair by rolling in the frozen snow. (The moult had at this season already begun.) The ears and nose were in continuous motion, and nothing — which to any degree could be considered dangerous — escaped their attention. Suddenly the animals one and all would rush together listening and watching to all sides; but just in the next moment they were quiet again and continued their chewing willow stalks and roots, which were still hanging out of their mouths.

If the hares had once become confident in my presence, they did not care for it later on, and I could make every kind of noise in their presence. I even tried to fire a shot, but this did not impress the hare flock much; only those individuals, which were occupied by chewing, stopped their activity for some few moments.

The dark coloured pairing limb of the male was at this season nearly always to be seen, even when the animals were asleep. The alpine hare does not yield any other sound, than that disgusting cry, which the wounded animal utters when captured; this is quite like the cry of the European hare. By the numerous examinations of killed hares which I undertook at every season of the year, it became evident, that this species only breeds once in the year in those stretches of land, through which the expedition passed; this fact could be anticipated on account of the climatic conditions of the country.

More or less developed embryos could be found from ultimo May till the middle of June — in a few animals some days later.

The number of embryos was as a rule 6, seldom 5 or 7.

One animal — shot at "Stormkap" on May the 31th and, as far as I could judge, a very old one — contained but 2 embryos.

The before named captured hare, which was caught on April

the 30th died on May the 28th while I was absent; the death was according to Dr. LINDHARD's opinion — a result of that moisture, which a several days' snow-storm caused in its place of residence. The animal contained 6 rather developed embryos.

Leverets of the size of rats were seen by LUNDAGER on June the 26th at "Snenæs"; he said, that the colour was bluish grey. July the 12th & 13th I shot two hares respectively at "Thermometerfjeldet" and "Harefjeldet", both the animals had still plenty of milk in their teats.

As before indicated the moulting already begins in April and is continued during part of July.

The alpine hare appears in this month as well as in the last half part of June in a most deranged hairy coat, because the rests of the old long winter hairs are sitting in scattered tufts on the body; this is now covered with short new hairs. The hare, which in the winter coat is chubby and pretty well shaped, can scarcely be recognized now.

Tendency to change of colour can in this period plainly be noticed on the front side of the head and ears, on which the yellow grey or bluish grey short hairs have taken the place of the long white hairs of the winter coat.

Dark hairs also emerge among the white on the back, but here they are more sparse.

B. THOSTRUP observed at "Sælsøen" on June, the 9th 1908 a hare, the right ear of which was black (dark?) on the front, while the left ear was of the usual white colour.

Both the old and the young hares appeared at the end of August in full winter coat. It is well known that this is snow-white with exception of the tips of the ears, which always are of dark colour, blue or dark-grey.

The young hares were still of a remarkably smaller size than the old ones; their weight was only 6 to 7 pounds (Danish) while the average weight of the full-grown was a little more than 8 pounds.

Any difference in size and exterior between the two sexes can scarcely be pointed out. Yet I think, that the nose region of the male is broader and bigger than that of the female.

On account of its chubby exterior the alpine hare looks in winter time a good deal larger than the European hare.

In N. E. Greenland the full-grown alpine hares have according to my experience but few enemies to fear. (See: *Canis lagopus, Canis lupus & Nyctea nivea*).

Though I am without personal experience in this direction, I feel sure, that the young ones of the hare are strongly persecuted

by foxes, ermines, snowy owls and ravens. According to my experience the alpine hare does not undertake real migrations.

The hares, which lived on the fells near the ship's-harbour, were nearly stationary all the year round; only in winter they undertook short excursions to the shore or to adjacent isles, from which they returned sooner or later.

For the zoological Museum in Copenhagen were — among other preparations — collected the skins of 10 hares, which were shot at different seasons, 16 crania and some embryos.

The following measures of crania have been taken:

Sex	Age	Date	Locality	Length from the hind part of the occipital condyle to the fore part of the præmaxilla in front of the fore teeth.
♀	ad.	17/2 08	Harefjeldet	88 mm.
♀	ad.	1/3 07	—	90 —
♀	ad.	14/2 07	—	87 —
♀		9/11 06	—	83 —
♀	ad.	3/3 07	—	88 —
♀	ad.	31/1 07	—	88 —
♂	ad.	15/2 08	—	87 —
♂	ad.	4/2 07	The ship's-harbour	86 —
♂	ad.	31/1 07	Harefjeldet	89 —
♂	ad.	15/2 08	Thermometerfjeldet	89 —
♂	ad.	3/2 07	Harefjeldet	86 —
♂	juv.	9/11 06	—	86 —

Lemming. *Myodes torqvatus* (Pall.).

In Greenland the species is bound exclusively to the northernmost and northeastern parts of the country. About the extension and biology of the animal some interesting observations exist which have been rendered in "Grønlands Pattedyr" by H. Winge.

The lemming appeared extremely common in the tracts visited by the "Danmark Expedition". As well on the highest mountain crests as on the lowest lying stretches of fen- and meadow land, as well near the inmost creeks of the fjord — ay, even far out on the inland ice — as on the little islands and rocks lying next the sea, one might be sure to meet with this peculiar little rodent animal, or to find at least unmistakable signs of its presence.

Most numerous I found the species in August and September 1906 in the low, fertile coast country lying between Rypefjeldet and

Hvalrosodden which was inhabited in the said period by thousands of lemmings. The territory was here on long stretches of way quite undermined by their passages and sown with their holes. The feathered enemies of the lemming, the snowy owl, the falcon, the arctic gull and the raven had their resort in great numbers to this territory during the autumn, and were living sumptuously on the abundance of the prey so welcome to them.

In the same autumn I also met with great numbers of lemmings in other localities rich in vegetation, as for instance on Koldewey Islands, the territory of Stormkap, on Snenæs and in the tract near the ship's harbour.

From the sledge travellers of the expedition I have received the following, rather scant notes:

Lamberts Land lat. 79° 8′ n. 11/4 07. Fresh traces of lemmings on the snow. KOCH.

Lat. 83° 10′ n. 18/5 07. In several places here and a little further to the south traces of lemmings on the snov. KOCH & BERTELSEN.

Lat. 82° 30′ n. 24/5 07. Observed even to-day fresh traces of lemmings on the snow. KOCH & BERTELSEN.

On their journey home the travellers again visited Lamberts Land — June 13th and 14th — where BERTELSEN now met with traces of lemmings in several places.

At the head of Sælsøen, near the border of the inland ice, LINDHARD observed April 7th 1908 some traces of lemmings. WEGENER and WEINSCHENCK state to have seen a great many traces of lemmings in Dronning Louises Land, 40 kilometers out on the inland ice.

Within the precincts which I personally had the opportunity of examining continually, the winter 1906—07 — as elsewhere mentioned — involved a strikingly great reduction of the amount of lemmings. According to my opinion the cause must be sought in the extremely low temperature of the first winter months, combined with a very insignificant snow-fall accompanied by violent storms which perfectly bared large areas of snow. (Vid. my common description of the nature of the country. As to the disturbing influence involved by the summer 1907 in relation to those kinds of mammals and birds, to which the lemming in these regions is as it were a condition of life, I can refer to the articles about the species concerned.)

When in the description of the Greenland lemming it has been asserted that the animal will stroll about in the open air all the year round (Vid: WINGE's "Grønlands Pattedyr" under *Myodes torqvatus*

and *Mustela erminea*), this does not at all apply to the parts of Greenland, from which my observations originate. It is true that the animal always led an active existence, but in the hardest winter and particularly in the time of darkness this life was carried on in concealment, chiefly in the system of passages which are made between the layer of snow and the surface of the ground. During the time of absolute darkness traces of lemmings were never observed upon the snow.

As a winter resort the lemming will always choose localities which, besides offering sufficient food for it, are provided with a layer of snow thick enough to afford the animal the necessary protection against the hard cold of winter. From this I feel justified to conclude that a winter like 1906—07 must prove fatal to great numbers of lemmings.

In the before mentioned passages made under the snow, the lemming will be strolling about busily during the winter. Here it finds its food — according to my experiences it is out of the question that a special winter supply may be saved up — and here the animal builds its nests or at least a part of these. The nests built under the snow are disproportionately large, almost globular and made of fine, faded grass which has been gnawed to pieces. Some of the nests found above the ground were carefully lined with musk-ox wool, or in localities where such was wanting, with the long, woolly hairs of the lemming itself. These lined nests looked as if they might have contained young ones.

Gradually as the earth was bared of snow in the summer time, in certain favourable places, mostly where great masses of snow had been lying, I was able to find great numbers of lemmings nests on the surface of the ground. Immense quantities of the dung of the animals, collected in conical piles or oblong heaps, gave additional proof of where the lemming spends its winter. My attempts of digging lemmings out of the snow were always in vain. I was often able to follow the main passage of the animals 15—20 meters along the surface of the ground. At last it would end blindly in the snow, if it were not in connexion with some subterranean tunnel. Such tunnels opened here and there, however, in the superterrestrial main passage. From the latter several short passages, always finishing blindly in the snow, were emerging on both sides. As a rule the dung of the animals was deposited in these side tunnels. Sometimes I found, however, a larger heap of dung as well, just inside the main entrance. During my attempts of excavation I never succeeded in coming across a veritable nest; on the other hand I found in several places in the principal passage stalks of

grass which were untidily heaped together. As far as I was able to observe, the lemming demanded in the coldest winter time layers of snow of at least one meter's depth.

Gradually as the sun rose over the horizon, the lemming appeared now and then outside of its hole. In February and the first half of March these visits in the open air were of very short duration, confined as a rule to the nearest surroundings of the entrance through which the animal quickly returned to its snug domain under the snow-drift. In exceptional cases I might have the opportunity of tracing a lemming some few meters along the surface of the snow, till it found a suitable spot for the placing of a new hole. It was evident that a longer stay in the open air still seemed too disagreeable to the animal and unsuitable to its purpose.

Towards the end of March it seemed as if the lemming's want of enterprising longer excursions were awakening. Traces of lemmings were now to be found daily, even in localities less rich in snow. Also on the ice of the fjord, sometimes far away from the nearest land, both my travelling companions and I myself often found traces of lemmings, nearly always belonging to singly walking animals.

As an instance may be stated that on a sledge drive across Stormbugt in the spring 1908, Jarner met with no less than fifteen different traces of lemmings, going parallel to one another. These traces were distributed on a distance of about 15 kilometers (from Baadskæret to Snenæs), leading all towards the continent in the north (Stormkap). According to the investigations of the narrator, all the lemmings must have gone out from the islands lying to the south in the neighbourhood of Teufelkap, having thus passed a distance of about 57 kilometers. As far as the observer followed the traces, they were kept in a straight line, leading without interruption (no experimental holes in the snow) towards the shore.

In the same spring the sledge travellers Trolle, Johansen and Hagerup found between "Koldewey Islands" and "Nordre Orienteringsø" some traces of singly walking lemmings. The animals had gone out from the first mentioned of these islands, making course for the latter. The place where the travellers crossed the traces of the lemmings, was situated about 10 kilometers from the nearest land. Fresh traces of ermines ran beside one of the lemming tracks. Also on the north-going sledge drives traces of lemmings were met with here and there on the ice.

In the choice of food the lemming is by no means particular. As far as I have been able to see, it will be content with any of the plants growing on land. I am not sure which of these it pre-

fers especially. Probably the lemming is fond of grass. At any rate I found the animals in great numbers during the summer time in localities, where tufts of grass were growing luxuriantly, as for instance at the old Eskimo graves, near singly lying, large stones, in boggy hollows of the ground and the like places. As a rule the lemmings had then nibbled off the tufts of grass, often to the very bottom. It was on such good lemming places that the snowy owls and skuas had their look-out stations, from which they were faithfully keeping watch over the holes which had been dug up recently.

The crusty snow which appears so frequently in the first months of spring, gives the lemming great trouble during its attempts of finding some food, after having left the passages under the snow, partly or for good and all. In March and April I frequently found on the snow lemmings which had been starved or perhaps more likely frozen to death. It was evident that in several places the animals had tried in vain to break through the glazing of the snow crust. The lemmings which were found dead under such circumstances were always lying rolled up tightly or crouched together.

On April 21st 1908 I thus found a young male in winter dress. Marks left by the animal's claws were to be seen all over the crust of ice in the neighbourhood. At a distance of 20 meters was a perfectly snowless spot, rich in vegetation, where evidently the animal had been seeking its food. The temperature was $\div 25°$.

How the lemming is able to brave hunger and cold during its long walks across the ice seems a mystery to me.

By nature the lemming is timid, suspicious not without reason, and as a consequence extremely cautious. This is the case especially when the animal is out in the light of day. The extraordinarily sensitive, much persecuted little creature, of which it has been said justly that its life hangs upon a thread, is the most nervous animal I know.

Like a flash of lightening the lemming hurries from one hole to another. Wherever it goes, death is following on the heels of it, even when it has retired to its subterranean dwelling. The fox quickly makes its way to the secret passages of the defenceless animal, and the ermine personally pays its bloody visits there.

The lemming is chiefly a nocturnal animal. In the summer I mostly found it strolling about at the time of day when the sun stood lowest. Nevertheless the animal is often seen above the ground in the middle of the day as well, especially in the summer time.

The hair change takes place in the end of May, probably a little earlier in the case of some specimens.

To the museum in Copenhagen 14 lemmings have been brought home — adult and younger animals. Four of these skins, the rest preserved in spirits.

The arctic fox. *Canis lagopus* L.

The arctic fox was extremely common on the continent and the larger islands, in the winter time also on small islands and crags and on the inlet ice. Even on the field ice, sometimes far from land, the expedition often met with foxes or the traces of these animals.

Most numerously the species was to be found in districts especially rich in lemmings, as in the low, fertile country between Hvalrosodden and Mørkefjorden, on Snenæs, in the territory of Stormkap and the tract near the ship's harbour. 86 foxes, shot or caught chiefly late in the autumn or in the winter were produced for examination. About half the animals killed originate from the immediate neighbourhood of the ship's harbour.

With regard to the appearance of the arctic fox outside of the precincts which I personally had the opportunity of examining, I have received the following notes from the sledge travellers of the expedition.

When travelling northward to lay out depots from $^{8}/_{4}$—$^{26}/_{4}$ 1907, P. Hansen observed in the district near Cape Amélie — lat. 77°30′ n. — four "blue foxes". The travellers saw a great many traces of foxes as well on land as on the sea ice. Also on the rather large island Isle de France, lying off Cape Amélie, they found innumerable traces of foxes. B. Thostrup who had joined the travellers, told me that on the south-west point of the island (Cape St. Jacques), they found the snow quite trampled down by foxes and bears. In the so-called "snow-foot" sloping down towards the coast, the foxes had made two burrows; one of them had been dug up by a small bear, evidently quite recently. From the traces it appeared distinctly that the latter had caught the fox in its den. Judging from the plain marks in the snow, the observer concluded moreover that the bear must have mutilated the fox in order to use it as a play-thing afterwards. During its involuntary intercourse with the bear, the fox had tried in several places to dig itself down in the snow. — The plundered fox's den, a sketch of which was brought me by the narrator, was only $3^{1}/_{4}$ meter deep.

A little more to the north, the same travellers came across numerous traces of foxes on the pack-ice, as a rule flanking traces of bears.

Notes from Koch's journey to the north:

11/4 07. Lamberts Land. Lat 79°10′ n. Several traces of foxes on the ice.

28/4 07. Lat. 80^{10} 80^{20} n. A great many traces of foxes at "Mallemukfjeldet" and the other bird cliffs here.

13/5 07. Lat. 82°50′ n. Bertelsen observed to-day traces of foxes on the ice.

19/5 07. Lat. 83°10′ n. Koch saw many fox traces on the ice.

24/5 07. Lat. 82°30′ n. Near some shot musk-oxen Koch saw a fox standing. It was evident that many foxes had visited the killed animals a little before.

6/6 07. Lat. 80°57′ n. A fox fled from the carcass of a seal, left by a bear.

10/6 07. "Mallemukfjeldet". Here are still more traces of foxes now than during our visit in April. Some well-kept Eskimo fox traps were found on the shore.

The notes of Lindhard from the north-going sledge drive in the autumn 1907.

14/10 07. On a glacier in the neighbourhood of some up-screwed ice with open cracks several fox traces were standing. Lat. 79°50′ n.

15/10 07. "Mallemukfjeldet". At the depot here two foxes were seen, a white and a blue one.

17/17 07. Lat. 80°10′ n. A blue fox was seen walking on the sea ice.

During his journey home Lindhard found — between "Lamberts Land" and "Nordre Depot" — the old sledge track flanked by a great many fresh traces of foxes.

From the diary left by Brønlund it appears that the fox has been rather common in "Mylius-Erichsens Land", the meat depots of the travellers here having been pillaged by foxes repeatedly.

In spring 1908 two journeys were undertaken to the inland ice and the large nunatak "Dronning Louises Land", lying 40 to 60 kilometers from the edge of the ice. Strangely enough no traces of foxes were found on these journeys. "Dronning Louises Land" was inhabited, however, by a great many lemmings, judging from the foot-prints seen. Probably it must be considered likely that the far-strolling arctic fox will haunt even these out-of-the way lying places, paying short visits there at any rate.

In North-East Greenland — as in other places — the arctic fox

is by no means particular in the choice of food, and in case of need it will be content with almost anything. Yet decidedly its chief and favourite prey is the lemming, and the great abundance of foxes in the country is probably due to this animal. As elsewhere mentioned the autumn 1906 was extremely rich in lemmings in the districts where I was wandering about, and every day I had the opportunity of observing one or several foxes exclusively occupied with the pursuit of the lemming. In exceptional cases I saw a fox on the beach or the inlet ice, in such localities on the whole where the animal might be supposed to search for food of another kind. The stomachs of about 40 foxes which I had for examination this autumn, nearly all contained rests of lemmings and almost nothing else.

In the winter 1906—07 the lemming disappeared almost completely from great areas of country, a fact which again involved a striking difference as to the manner of living of the fox. It is true that even in 1907 I now and then saw foxes in pursuit of lemmings, but the profit of this chase was extremely insignificant, as was shown distinctly enough by the stomach analyses made. The foxes were obliged to take up other means of living. Often I saw them intruding themselves on the ice bears, trying very obtrusively to get a part of their meals and even eating their badly digested excrements with great voracity. I now often found rests of seals in the stomachs of the foxes. Along the shore and near open cracks in the ice, the fox was also frequently to be found, probably seeking to get hold of the little fishes or other small marine animals which had been washed up here or screwed up by the current. In a few stomachs of foxes I found bones of fishes.

The meat depots of the expedition were now haunted by foxes more than formerly, even in the early autumn, when normally the fox will be revelling in lemmings. In August 1907 a shot walrus was thus deposited near the coast on Snenæs and carefully overheaped with large stones and a thick layer of earth. By means of an incredible energy the foxes made their way to the carcass which became quite undermined by fox passages in comparatively short time. When some of the travellers went to get the meat later on, it had been completely devoured by foxes. (Near this depot a white wolf was seen as well.) In October five foxes were caught at the depot, and at least twice the number was seen. The five foxes were all extremely well-nourished. In their stomachs walrus meat was found most essentially.

On Hvalrosodden some rests of walrusses were likewise deposited. Here the foxes appeared in still greater numbers than on Snenæs.

No less than eleven foxes were shot or caught by one single man in the course of two days. Even these foxes — with a few exceptions — were very fat, and it was evident that they had been living sumptuously for a good while on the provisions which were intended for the sledge dogs of the expedition.

Yet in the severest winter time it was hard work for the fox to procure sufficient food. Under the deep layers of snow it was difficult to gain admission to the lemming, the birds had left the country, and thick ice closed the pantries on the inlets and the sea.

The constant snow-storms especially gave the fox great trouble. Under those unfavourable conditions the foxes showed themselves extraordinarily forward. I often saw them sitting close to the ship's side or near the houses on the beach. Empty conserves boxes which had been thrown out, were licked quite clean by the starving animals, no matter what they had contained. Even the hard frozen dung of the dogs was not despised by the foxes. I found a fox's stomach quite filled with bits of rope and string which had been gnawed to pieces. They were very easily caught in the springes and traps set out for them, though often the bait employed might seem anything but tempting. I thus caught seven foxes on one day. Repeatedly I found the foxes which had been caught in traps, torn to pieces and partly devoured by their hungry companions. The chief part of the foxes caught in winter were extremely emaciated. — I did not find any rests of vegetables in the fox's stomachs which I examined, not even at times of the year, when the animal's conditions of support were the most severe. Moreover the vegetable dishes which North-East Greenland is able to offer, especially in the winter, are anything but inviting to a carnivorous animal, even to an arctic fox.

On the edge of those holes in the snow which had been dug up by the fox in its search for lemmings, I very often saw the hard frozen stomach of the lemming, highly distended by vegetable matter, lying side by side with the dung left by the fox. That a hungry fox will reject such a disproportionately large part of the hardly gained and highly favoured prey which decidedly the lemming is, seems to prove that on the whole the animal does not eat any of the plants growing in these tracts of the country.

Gradually as the ptarmigans appeared in the country in February and March, the fox was also seen in pursuit of these. Yet I never had the opportunity of seeing the animal carrying on this chase with profit. In a single case I found some feathers of ptarmigans lying outside the entrance to a fox's den.

During its wanderings on the ice the fox does not hesitate to

force the open cracks and small holes which it comes across on its way, if the cold is not too severe, and as a rule it does not leave the route once chosen on account of such insignificant impediments.

In a single case however, I witnessed how a fox got his coat wet, very much against his will. From the top of the little rocky island Maroussia facing towards the field ice, I saw one afternoon in the end of October 1907 a blue fox trotting about among the distant ice-bergs. At last the fox made his course right for the island, running very quickly, probably intending to spend the night here, where several lemmings were to be found. It was freezing hard — about ÷ 30. In order to reach the island, the fox was obliged to pass a belt of open water, cut by the current, in which some larger and smaller patches of ice were drifting about. In the immediate neighbourhood of the island a very thin layer of new ice without any flakes had just been formed. With astonishing precision and elegance, the agile animal jumped at first from one patch of ice to another, till it reached the edge of the treacherous new ice. Cautiously the fox tried with his fore paws the bearing-capacity of the latter, setting out afterwards — not without the most evident hesitation — to cross the glassy plane. Suddenly the ice broke. For a long while the attempts of the fox to gain a firm footing by swimming away from the coast did not succeed, the ice breaking down on all sides. At last the poor animal was fortunate enough to get up on the nearest drifting flake of ice, apparently extremely exhausted from his cold bath. After having shaken his coat several times, the fox began to work upon it with his tongue. For about an hour he was busily occupied in this way. With the funniest twists of his body he tried to lick every spot of his coat all over. At length the darkness had fallen, yet the short distance permitted me to distinguish the fox, as he was jumping from flake to flake like an India-rubber ball, till at last he disappeared for ever in the endless space.

In the summer time the arctic fox may easily supply itself with food in abundance. On the snowless ground it gains admission to the lemming without difficulty, and in years less favourable to the lemmings, it will find ample nourishment in the brood of the birds. During my permanent summer residences in the district near Stormkap, I almost daily met with foxes on the breeding places of the small wading-birds. Some of my "observation nests" had been pillaged by the fox which easily found its way to them, guided by my foot-prints.

Along the shores of inlets and freshwater lakes I often came across traces of the fox, and I suppose that very likely it will

devour the lower animals appearing in such places, for a change. Perhaps the fox will also eat insects. Though my opinion is not founded on positive observations, still I feel convinced that the fox is a dangerous enemy to the young of the polar hare. The adult hare on the contrary has nothing to fear, judging from my experiences. I very often saw foxes and hares in the immediate neighbourhood of each other, even under circumstances, where it seemed as if the fox might easily take the hare by surprise, if it cared to hunt it at all. The two animals did not seem to heed each other in the least. I have made these observations at all seasons of the year. As an example the following may be stated.

In the end of March 1907 I was staying about twenty kilometer north-east of the ship's harbour. Near the coast an extensive, almost flat plain is situated, on which an isolated little mountain knoll, most like a burial mound in form and size, rises a few meters above the ground. Here some foxes had their usual place of resort every day. It was just in the pairing time, and the male foxes were incessantly pursuing the female that was present, sometimes on the top of the hill, sometimes round the foot of it, striking up at the same time the most fearful concert of howls. The snow was trampled down completely by the foxes everywhere. Out on the plain I found fresh traces of a hare, and following these I saw to my astonishment that they led to the "fox's hill", on the top of which the hare was sitting quietly enough and half asleep, while the foxes were bustling about quite close to it. On the following day I again paid a visit to the place, finding the hare once more sitting in the midst of the company of foxes. At my arrival four of the foxes reluctanctly retired a little way out on the plain, while the hare indolently jumped a few steps down the slope to go on with its nap there.

In the comparatively large number of fox's stomachs which I examined, I never found hairs or other rests of adult hares — nor of leverets, as I have mentioned before — and likewise I found in no case in the dung of the fox or outside its dwelling anything which might prove that a hare had been devoured. According to these observations I presume that the small and comparatively weakly built arctic fox must consider the larger and in some respects far more powerful polar hare as an animal far too imposing and hardly obtainable to make it an object of pursuit.

The foxes sought with great avidity the traps where I had employed the skins and entrails of hares as a bait.

The arctic fox is an extremely pleasant little animal as well in manners as in aspect — this does not apply, however, to its extre-

mely deranged appearance during the period of the hair change. Its movements are at the same time graceful and swift as lightening. Like an India-rubber ball the nimble animal will jump up and down the steep snow-drifts, coated with a glazing of ice, and it sweeps across the snow-covered mountain side or over the sea ice, as if it were carried on wings. Under the difficult conditions of life the senses of the fox have been sharpened to the utmost. It is undoubtedly most beautiful to observe, when it is strolling about in pursuit of lemmings on a sunny autumn day. Like a tuft of cotton wool, periodically carried along by the wind, it chases across the mountain slope or meadow land, always spying, listening and sniffing the air. Even when hurrying along at the utmost speed it discovers with never failing certainty the lemming which is hidden under the snow and quickly makes its way to it by means of its strong claws and fore limbs. With three or four powerful jumps the fox lets itself fall down in the snow pit, its body hanging down perpendicularly and the tail stiffly out-stretched behind, and it will go on in this way, till it has got the dainty bit between the teeth. For some moments it tarries on the spot and then hastens on again. Soon it is seen once more occupied with its work of digging and its strange caprioles.

Towards human beings the foxes always showed a certain caution, though at times they might be very impudent, when compelled by hunger.

When a fox suddenly caught sight of me, it would rush on to meet me curiously, with a few disconnected jumps, then it turned round abruptly, running at the utmost speed towards some mountain crest or large stone which it climbed with inconceivable dexterity, and from the top of which it would watch me for a long while, standing motionless with the tail out-stretched horizontally. In this position the fox often at fixed intervals uttered a short bark or a long-drawn, far sounding howl. The foxes caught in traps as a rule threw out low yelps, very much like those of a small puppy, and broken in the same manner by fixed pauses. In the summer time, while the hair change is going on, the fox screams incessantly its shrieks being a mixture of barking and mewing which sounds most hideously.

The arctic fox is mostly astir in the night — in the dark season and when the hair change takes place it will move about at all hours. Yet I also saw the fox hunting in the day-time, especially early in the morning or late in the afternoon. In the middle of the day and when the weather is fine it likes resting on a sunny and grassy spot, surrounded by blocks of stone and not too high

up in the mountains. In rough weather the fox always sought its den. The latter I generally found on low slopes facing southward. Most of the dens which I found had only one, rather narrow entrance, hidden away among a couple of big stones, under some low, pendant brink, between large tufts of grass etc. (often near the water). In May 1907 I found on the low rock "Udkigshøjen" near Hvalrosodden, two fox's dwellings not far from each other, both provided with a whole system of passages leading in and out. These were all easily visible and not so narrow as usual. Everything seemed to imply that these dens had been used for many years as breeding places. Outside the snow had been quite trampled down by foxes, the excrements of which were covering the ground in large heaps. Bones especially of seals, and feathers of birds, among others some belonging to a white ptarmigan and a young sea-gull (*Larus glaucus*) were spread all over the hill. Even these dens were facing southward. The excrements of foxes examined here chiefly contained hairs and fragments of lemming bones.

In the winter the arctic fox often dug long passages through the snow-drifts. Such passages were as a rule continued in the proper entrance to the den which lay in the earth.

The fox always came back to its dwelling. In the winter, when the animal undertook long excursions on the sea ice etc., several days and nights might pass away however, before I found once more its foot-prints near the entrance to the den.

The pairing took place in March. From 10^{th}—13^{th} March 1907 I daily observed the conduct of the foxes during the pairing at Hvalrosodden. It was very cold, up to ÷ 42°. Nevertheless the foxes were strolling about busily both day and night. I often saw several males eagerly pursuing a female. The motions of the animals are under these conditions very unlike their usual manners. In a strangely jumping, short gallop the males were hurrying after the females, always with their noses close to the foot-prints of the latter. Once I saw five white males pursuing a blue female in this way. As a pairing place the foxes here chose the small, snow-covered icebergs lying a little way off the coast, some of which were perfectly soiled by the foxes and covered with their foot-prints. On such an ice-berg I saw in the middle of the day a white male and a blue female pairing. In the immediate neighbourhood three other foxes were standing — two white and a blue one — undoubtedly all males.

On March 17^{th} I again visited the same localities, but this time I did not see so many foxes. At the inner part of Dove Bugt I observed a couple of foxes near some low ice-bergs close by the coast.

The animals were trotting round after each other, always in the above mentioned strangely jumping gallop, till at length they paired. In this case the male was blue and the female white. The observation took place early in the afternoon in 38 degrees of cold. A week later I saw in the territory north-east of the ship's harbour some pairing foxes, their meeting place being the above described mountain knoll in the middle of a plain near the coast.

I never saw quite small fox's cubs. Two half-grown cubs, belonging to different litters, were shot in August 1906 near Hvalrosodden. Both animals were very short-haired and had as near as possible the same bluish grey colour marked with lighter parts on the belly and along the sides. The skins were brought to the museum. (Vid. fig. 1 pl. I).

In the beginning of October the young foxes from the same year had put on a more long-haired winter dress. With all the young foxes which I saw, this coat was of a dingy, withish blue — lighter or darker — "mezzo tint". Four animals in this colour stage, shot in the end of October and the beginning of November were brought home to the museum. (Vid. fig. 2 and 3 pl. I). While one of these young foxes had just shed its milk-teeth, the three others were still shedding their teeth.

A young, not quite full-grown fox of light, whitish blue colour was caught October 14th 1906 and brought on board alive. The animal already wore a thick, rather long-haired winter coat. This fox died Decbr. 17th the same year, bitten to death by a dog, having at this point of time almost assumed the colour of the adult white fox. Along the back and on the upper side of the tail however a faint, whitish blue tint was still to be distinguished.

Towards the end of the winter and in the spring months I never saw foxes of the above described whitish blue mezzo tint. This fact combined with observations of the colour change of the imprisoned fox shows that the young, whitish blue animal, while reaching its full development in the course of the winter, assumes the constant, perfectly white winter coat of the adult white fox through a successive change of colour and not by shedding the hairs. Strangely enough I never, as before mentioned, saw a young, not yet full-grown fox, the colour of which was so dark that it might convey the impression of turning constantly blue at length. Neither did I meet with older animals in whitish blue coats. These were in the winter dress quite white or quite blue. As a rule the white foxes had a few dark hairs collected on the utmost tip of the tail, more rarely on other parts of the body. In the beginning of the winter the white foxes had some bluish grey hairs on the back

of the ears, just as the white hairs on the body had a bluish tint at the bottom. In February, March and April the white foxes were finest, the covering hairs being now longer, dazzlingly white and soft as silk.

The blue foxes often wore a little tuft of white hairs on the front of the breast or at the tip of the tail. They varied rather much in colour however. Some were uniformly blackish blue, others had a peculiar reddish tint along the back. Still most of the blue foxes had on the upper side (head, back and tail) a smaller or larger amount of white hair-tips, the distribution of which varied very much. Without exception the blue foxes were darkest on the belly which might be quite black in some animals.

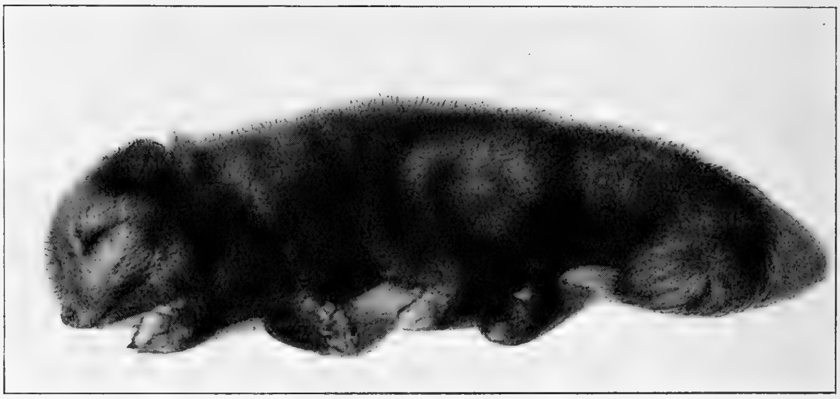

Fig. 17. Shot blue fox. March 1908.

Out of all the foxes killed on the expedition 76 adult animals were in pure winter dress. 31 of these were blue, the rest white.

The division of the sexes was as following

Blue	11 females 18 males 2 without designation of sex.	White	13 females 27 males 5 without designation of sex.

In the middle of May the hair change began. Before that time the blue foxes had assumed a strongly faded reddish or yellowish colour which was especially conspicuous on the upper side of the animal. During my summer residence at Stormkap I daily saw foxes in the motley coat of the hair-shedding. The animals were now astir all day long. The highly deranged hair-covering gave them an ugly and discordant appearance, and I was hardly able to recognize the beautiful, lively arctic fox from the autumn and winter. With a wide-sounding, incessant screaming or mewing the

	1 4/11 1906 Hvalrosodden ♀ ad. (Blue)	2 3/2 08 ♀ ad. (Blue)	3 10/10 07 Stormbugt ♀ ad. (Blue)	4 19/11 07 Stormbugt ♀ ad. (Blue)	5 29/11 06 The harbour ♀ ad. (Blue)	6 12/10 07 Stormbugt ♂ ad. (Blue)	7 ? ? ♂ ad. (Blue)	8 8/10 07 ? ♂ ad. (Blue)	9 20/4 07 The harbour ♂ ad. (Blue)	10 15/2 08 ? ♀ ad. (White)	11 25/3 07 The harbour ♀ ad. (White)
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Length of the upper row of cheek teeth	48	47	46	47	45	48	48	48	47	48	45
Length of upper carnassial tooth	15	14	13	14	14	15	14	15	14	14	14
Length of the lower row of cheek teeth	53	50	51	51	51	52	52	54	51	52	50
Length of lower carnassial tooth.......	15	14	13·5	15	14	14·5	15	15	14	15	14
The total length of the cranium....... (measured from the hind edge of the condyle to the front edge of the intermaxillary bone)	122	116·5	119	115	116	119	118	124	119	118	115

	12 15/11 07 Stormkap ♀ ad. (White)	13 27/10 07 ? ♀ ad. (White)	14 5/11 07 Stormbugt ♂ ad. (White)	15 26/10 07 Snenæs ♂ ad. (White)	16 3/11 06 Hvalrosodden ♂ ad. (White)	17 26/10 07 Snenæs ♂ ad. (White)	18 9/10 07 Stormbugt ♂ ad. (White)	19 4/11 06 Hvalrosodden ♂ ad. (White)	20 30/10 06 The harbour ♂ ad. (White)	21 4/11 06 ♂ ad. (White)	22 29/10 07 The harbour ♂ ad. (White)
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Length of the upper row of cheek teeth	46	45	48	49	48	49	49	48	49	46	43
Length of upper carnassial tooth	14	14	14	14·5	15	15	14	14·5	15	14	14
Length of the lower row of cheek teeth	49	49	53	54	54	54	53	53	54	52	50
Length of lower carnassial tooth... ...	14·5	14	14	14	15	15	15	15	15	14	14
The total length of the cranium....... (measured from the hind edge of the condyle to the front edge of the intermaxillary bone)	119	113	119	123	120	121·5	119	121	122	117	112

	23 18/12 06 The harbour ♂ ad. (White)	24 4/11 06 Hvalrosodden ♂ juv. (Whit.bl.)	25 4/11 06 Hvalrosodden ♂ juv. (Whit.bl.)	26 30/10 06 The harbour ♀ juv. (Whit.bl.)	27 4/11 06 The harbour ♂ juv. (Whit.bl.)
	mm.	mm.	mm.	mm.	mm.
Length of the upper row of cheek teeth	47	40	40	44	36
Length of upper carnassial tooth	14	15	14	13	13
Length of the lower row of cheek teeth	52	48	42	47	43
Length of lower carnassial tooth.......	15	15	14	13·5	13
The total length of the cranium....... (measured from the hind edge of the condyle to the front edge of the intermaxillary bone)	120	114	105	103	104

Notes.

	Running No. 9	Running No. 2
The length of the upper arm	105 mm.	99 mm.
Length of the thigh-bone....	106 —	100 —

No. 12. The hindmost cheek tooth in the lower jaw is wanting.

No. 24, 25 and 27 were shedding their teeth.

wretched-looking foxes were trudging about in bogs and fens. Tufts of the old hair were left in larger portions or like narrow stripes all over the body of the animal. Head, neck and parts of the tail were first released from the long winter hairs, and in this way the physiognomy of the fox assumed an increased comical appearance. An old female in the coat of the hair-shedding (killed in the end of May) was brought home to the museum. (Vid. fig. 4 pl. I). All the foxes which I saw in the summer time were more or less variegated in colour.

In the end of August the hair change was completed in the case of most foxes. On August 29th 1907 I caught three foxes — two blue and a white one — all in winter dress. Two days before however I had observed a fox which had not changed its coat altogether.

To the Zoological Museum in Copenhagen the skins of 10 arctic foxes in different ages and coats have been brought home. Moreover a couple of animals in spirits, about 40 craniums etc.

The arctic wolf. *Canis lupus* L.

According to the hitherto existing observations it must be considered that the arctic wolf is an animal very rarely to be met with in Greenland, moreover its appearance is bound exclusively to the northern and north-eastern parts of the country.

That the Greenland wolf has immigrated from arctic North America — its proper home — is beyond every doubt. About the exact time for this migration only guessings can be made as we are not able to prove anything definite on basis of the comparatively few investigations which have been made so far.

In "Grønlands Pattedyr" by H. Winge everything that is known about the species from Greenland until the year 1902 has been gathered under the heading: *Canis lupus.*

Compared with the observations of former expeditions it might seem as if the arctic wolf appeared somewhat more commonly in the parts visited by the Danmark Expedition than elsewhere in Greenland, wolves having been seen and sure evidence of their appearance found, though relatively somewhat spread, from lat. 75° n. (Hochstetters Forland) to lat. 83°10′ n. No less than five adult wolves were killed and carried home.

In preference to most other expeditions in North and East Greenland the Danmark Expedition had considerably increased chances of making a close study of the animal life, partly through a protracted sojourn in the country, also in times of the year when traces of animals are to be found easily, and partly through the extraordinary great number of sledge drives made to the most different parts of the tract of country concerned.

In the following I shall render an account of the most essential observations which were made on the expedition concerning the arctic wolf.

Only a few days after our arrival to the country I found sure evidence of the presence of this rare beast of prey, exactly in those parts where I personally was most likely to be strolling about during the coming two years, having seen on an excursion to the country near Hvalrosodden, on August 21st 1906 fresh traces of an adult wolf, walking alone. Along the clayey banks of Lakseelven, in dried-up river beds and other hollows in the ground, as well as on the partly snow-covered shores of Sælsøen, the wolf had been trudging about. A widely sounding howl from the high mountains north of the lake gave me further assurance of the presence of the animal. Also beyond Lakseelven and in the clayey, low-lying grounds stretching towards the evenly sloping musk-ox mountains I was able to trace the wolf during the first following days.

On the above mentioned mountains seven musk-oxen were shot on August 25th. Some days passed away in transporting the meat and skins of these animals to the tent camp at Hvalrosodden 16 kilometers distant, and when on the evening of August 28th, after having been occupied with the killed musk-oxen, I was about to return to the tent, I suddenly caught sight of a white wolf which was staring down upon me from the top of a mountain crest, at a distance of 7—800 meters.

Feeling sure at once that sooner or later the wolf would pay a visit to the meat, and having found by closer observation that such had been the case during the previous nights, I resolved to await the coming of the animal. Wrapped up in the skins of a couple of musk-oxen, partly to resist the cold night air, and partly to divert the attention of the animal from my presence through the rank smell of the skins, I lay down in ambush not far away from the meat.

The wolf showed itself all along extremely cautious and shy. Now and then it was trudging slowly down in my direction, but only to turn round suddenly and make for the above named mountain crest in long jumps. After some time the animal left its station,

restlessly and nervously, and trotted away to a higher mountain lying behind, where I lost sight of it for some hours. Not till about midnight did the animal appear again, following the bottom of a deep-lying, dried-up river bed, this time about 120 meters away from the carcass. From a low mountain knoll the wolf stood staring and violently snuffing down towards me, till a rifle ball quickly made an end of its life.

It proved to be an old female with much worn canine teeth and blunt nails. With exception of the long hairs on the top of the back which have bluish grey points, and a spot on the upper side of the tail a little below the root of the tail, having the same bluish grey colour, the animal is white. Yet the back of the ears has a greyish yellow tint.

On the newly shot, unskinned animal I took the following measurements:

Length from point of muzzle to root of tail	108 cm.
Total length of the tail	42 -
Head from neck to muzzle	30 -
Length of the ear	10 -
Breadth of the ear........................	10 -

The wolf that was shedding its fur, was well nourished, almost fat, and weighed 35 kilogrammes. In the stomach the animal had ample rests of tallow and musk-ox hairs, fetched doubtlessly from the above mentioned shot animals.

The same night — about $1^1/_2$ hours after I left the place — Mylius-Erichsen, B. Thostrup, Jarner and Johansen arrived there to take some of the meat. While they were lying down at a distance to rest after the walk, two white animals appeared near the meat, and according to the statement of all the eye-witnesses they were wolves, apparently somewhat smaller than the newly killed specimen. Mylius-Erichsen aimed a shot at one of the animals, but probably because the twilight had fallen and the distance was too great, it remained unhurt and fled.

In order to get a chance of seeing the animals myself, and of shooting them eventually, I kept watch by the carcasses of the musk-oxen during the following night, in company with B. Thostrup, but this time I did not see any wolf. As a couple of white arctic foxes appeared near the carcass and showed themselves rather forward, I asked the observers later on, if it were not possible to make a mistake between foxes and wolves, but they denied this unanimously, and it seems to me that there is no reason to doubt their words. The fact that on my excursions in the environs of the

musk-ox mountains, I had hitherto only found traces of an adult wolf walking alone, was the only reason for my immediate doubt.

According to the observations which I had the opportunity of making later in the autumn 1906, it seemed evident that the country west and north of Hvalrosodden, especially the mountains round Sælsøen and Mørkefjorden, were inhabited by some more single wolves, the traces of which were often to be found along water courses and lakes farther out on "Hvalsletten" towards the east, but always returning to the above named groups of mountains, where probably also a few smaller herds of musk-oxen had their place of refuge. Moreover the traces of these animals were frequently found in the lower territory.

It was therefore a great surprise to me that a hunting expedition, in which I joined myself, going to Hvalrosodden in the first half of March, did not meet with a single trace neither of wolves nor of musk-oxen, in spite of eager searching and good opportunities for finding the tracks. Thus the presence of the animals in this and the nearest preceding time must have been bound to the regions more difficult of access for human beings, in the heart of the country and high up in the mountains.

On May 28th 1907 I again visited the tract near Hvalrosodden, and this time I found in many places fresh foot-prints of wolves in the lowland, thus along the shores of Gaasesøen, Lakseelven and in the deep ravines north of this river, always belonging to singly walking animals, perhaps to one specimen everywhere. By the tent which stood in the immediate neighbourhood of the beach, and outside of which some shot polar hares were lying, I found in the morning quite fresh traces of a wolf on the snow. Yet the wolf which had been walking across the plains in the direction from Sælsøen, had not ventured quite close to the tent, but at a distance of about 200 meters he had turned round and made his way back to the lake.

On August 4th 1907 I found on the sandy beach between Snenæs and Hvalrosodden fresh traces of an adult wolf. When on the following day I arrived at Hvalrosodden, where ample remains of some walrusses which had been killed the year before, were still lying, I found here plenty of fresh traces of wolves, partly near the carcasses and partly in the neighbouring hollows and in the sandy or clayey glens and river beds.

The animal or animals — judging from the different size of the foot-prints two wolves had been in company — had always chosen the same route to and from the carcass, and it was evident that

having finished their meal, they had returned as usual to the mountain near Sælsøen.

Between the above named tent place and Rypefjeldet I found a few days later two large pieces of walrus meat which had been dragged away by wolves from the carcasses on the headland. Fresh foot-prints of wolves and innumerable traces ot foxes were left round the pieces of meat which bore distinct marks of the teeth of carnivorous animals.

On October 9th 1907 one of the partakers of the expedition, Hagerup, on his way from Hvalrosodden to the ship passed "Lille Snenæs", where a depot of meat (a walrus) had been placed. When Hagerup left the sledge to go towards the depot, he saw a white wolf standing near it. At his arrival the wolf fled, uttering some deep howls, and did not appear any more.

At the observation house in "Pustervig" not far from Mørkefjorden a wolf, the traces of which stood distinctly on the newfallen snow, had paid a short visit during the night between October 10th and 11th. At a distance of 4 meters from the house the animal had heen sitting down on his haunches, following afterwards his own traces in long jumps back across the steep mountain side.

On October 26th Lundager and Koefod found numerous traces of wolves in the snow round the depot at Lille Snenæs.

On October 24th 1907 — lat. 78°45′ n. — between Lamberts Land and the large island to the south of it, Dr. Lindhard saw fresh traces of a wolf which had come up close to the tent (on the ice), after which the animal had walked away in southward direction.

May 18th 1907. Lat. 83°10′ n. On a mountain plain 500 meter high, Koch and Bertelsen saw fresh traces of a wolf. (Bertelsen brought a drawing of the foot-prints home.) On the same plateau numerous traces of musk-oxen were found.

In a letter from Mylius-Erichsen, dated May 28th 1907, mention is made of a wolf seen at Danmarks Fjord — lat. 81° n. long 22—25° w. In vain the travellers shot at the wolf which proved very shy. (In the same letter is a note about 21 musk-oxen having been shot at Danmarks Fjord.) Probably it is the same white wolf which is mentioned in the diary left by Brønlund, according to which the wolf was seen on May 24th. In company with two sledge dogs the wolf stood eating some musk-ox meat left by the travelling party; the animal was very shy and fled before Brønlund came within shot of it.

At the metereological station at Pustervig a dog which had been staying some time at the station, suddenly disappeared (the

night between December 25th and 26th), doubtlessly snatched away by wolves.

On January 6th in the forenoon, Hagerup and P. Hansen left the said station at Pustervig in a sledge, drawn by 9 dogs. When the travellers had come a little way out on the ice of Dove Bugt, three white wolves came rushing from the beach in direction of the sledge. The travellers taking the animals to be bears in the dark, let a couple of the dogs loose as usual when bears appeared. Against custom the dogs seemed at once very anxious, and while one of them fled back to the sledge trembling with fear, the piercing howls of the other showed that it had been attacked by the supposed bears. The sledge arriving at the fighting place, one of the animals fled, while the two others remained standing defiantly, till the travellers shot at them at a very close distance, yet without hitting on account of the darkness. Through closer inspection of the foot-prints of the animals, they were proved to originate from wolves. During the drive back to the ship's harbour the sledge was pursued all the way by the wolves which showed themselves very impertinent now and then, to the great terror of the dogs.

In the following days these wolves were always to be felt in the immediate neighbourhood of the ship. By means of a lantern I was able to find the fresh traces of the animals everywhere, often leading close to the side of the ship, along which the sledge dogs of the expedition were staying, protected to a great extent by sheds and caves built in the snow. The dogs showed their terror of the wolves uttering plaintive howls and barricading themselves on the ship's deck and on the roof of the house lying on the beach. As soon as a dog was imprudent enough to get a little way off from the ship, the wolves came rushing to snatch it away. No less than four dogs were devoured by the wolves, and several others returned to the ship wounded. As a rule the wolves would flench the skin away from the top part of the dog's head besides inflicting wounds on the animal's belly. The remains of the dogs that had been bitten to death and devoured, were found in the shape of tufts of hair not far from the ship, never on the ice, yet generally in the neighbourhood of the beach.

On account of the darkness and the frequent snow-storms it was at first very difficult, not to say impossible, to make any attempt of hunting the wolves, and not till January 11th did the weather permit me to set up some traps for the wolves a few kilometers from the ship. A frozen dog's carcass which I found on the deck of the ship was employed as a bait. The immediate result

was the catching of a big old male wolf, the colour of which was very much like that of the above described female.

A few measurements taken on the newly killed, unskinned animal will be stated here.

Length from point of muzzle to root of tail	119 cm.
Total length of the tail	46 -
Height from sole of foot to upper edge of shoulder-blade	76 -
Circumference of the body, measured directly behind the fore limbs	75 -

Iris greenish brown. Weight 29 kilogrammes. The nails much worn. Contents of stomach: remains from the bait.

Fig. 18. Arctic wolf caught in a trap.

The wolf had on his nose a deep wound, some few days old, of the size of a halfpenny, probably originating from the bite of a dog, besides a larger, partly healed wound in the right groin, where the hairs had fallen off partially in a stripe the length of about 35 cm.; the remaining hairs were quite short in this place and of a yellowish brown colour which had been produced probably through the animal's rubbing his muzzle, soiled from the carcasses, against the adjacent hairs, while licking his wound continually.

The fur of the animal is long- and rough-haired, especially along the upper part of the neck and on the back. In contrast to the female wolf shot in August 1906, this animal was extremely emaciated which was shown moreover through the extraordinary insignificance of its weight.

At the catching place the snow had been trampled down completely by wolves, and it was evident that all three animals com-

bined had devoured the dog thrown out, the greedy beasts of prey having left only very scarce remains of it: a few splints of bones and some tufts of hair. The fact that the stony body of the dog which I had tried in vain to quarter by means of an ice-axe before throwing it out, had been devoured by the wolves so completely, proves the extreme strength of the bite of these animals and their immense greediness.

The two remaining wolves appeared almost daily during a time, especially in the night and in violent storms, close by the side of the ship, but strong and continual snow-drifting made it impossible to use the traps which were covered with snow in the very moment they were set up. Often the men shot at the wolves from the ship, yet the animals did not seem afraid for that reason. Not till the light dawned in the middle of the day so much that larger objects might be distinguished at a rather long distance, did the wolves begin to show themselves less bold.

The two animals were nearly always in company. Very rarely did they wander away from the ship, but kept so close to it that every chance of getting some food there might be turned to account. Now they were lying on the snow-drifts on the lower slope of Thermometerfjeldet, now they were trudging about with hairs bristling and tails drooping, along the screwed-up ice on the beach, or galloping across the harbour. Defiance and cowardice characterized their nature. Their aspect strikingly reminded one of a couple of miserable stray dogs which had been reduced to live on their own initiative. Their howling was heard now and then, especially towards evening.

A sledge party left the ship on February 4th to go to the station at Pustervig; both the wolves accompanied it. The weather was rough and stormy, the snow was drifting, and the temperature went down to $\div 36°$. The wolves became more and more impertinent, often approaching the sledges at a distance of no more than 20 meters. The twilight and the unfavourable weather made the use of fire-arms impossible. On account of the storm it was resolved in the evening to pitch the tent at Hvalrosodden. Still the wolves made themselves felt in the neighbourhood. Next day in the forenoon, while the storm was still raging violently, wailing howls of the sledge dogs were heard just outside the tent, and the Greenlander HENDRIK ran out with his rifle. He found both wolves fighting with the dogs, and while the larger wolf fled at his arrival, the other remained standing over a dog which it had thrown to the ground, tearing it with great ferocity on head and belly. HENDRIK ran up and shot the wolf at a distance of a few steps.

The second wolf at once made for the ship's harbour, reappearing there a few hours later. (From Hvalrosodden to the harbour is a distance of 41 kilometers.)

The killed wolf was an adult, but probably not very old female. The colour of the animal is exactly like that of the two preceding wolves.

On the newly shot wolf the following measurements were taken:

Length from muzzle to root of tail ...	109 cm.
Total length of the tail	44 -
Height from the sole of the foot to the upper edge of the shoulder	73 -
Circumference (behind the fore limbs).	67 -

Fig. 19. Shot arctic wolf.

Weight $20^1/_2$ kilogrammes. Extremely emaciated. Teeth and nails not much worn.

On February 13th the last of the three wolves was shot near the ship.

It was a very old male of the same colour as the previously killed wolves.

Length from muzzle to root of tail ...	114 cm.
Total length of the tail	41 -
Height from the sole of the foot to the upper shoulder edge	76 -
Circumference (behind the fore limbs).	79 -

Weight 25 kilogrammes. Very emaciated.

On March 8th two sledge travellers (LUNDAGER and HENDRIK OLSEN) saw on their way from Hvalrosodden to the ship's harbour traces of a wolf which had crossed the ice from Hvalrosodden to Snenæs. The newfallen snow proved that the traces were quite fresh.

On March 9th JARNER saw a white wolf trotting across the peninsula at Cape Bismarck. Later on I went out and found the footprints of the wolf everywhere among the screwed-up ice, and eventually I ascertained that even this wolf had at last walked out towards the ship. The animal itself I did not see, probably on account of the growing darkness. (Evening.)

From March 10th—22nd the wolf disappeared from the ship

Fig. 20. Canis lupus ♂.

entirely, and it was proved later on that it had followed the sledges of KOCH and GABRIELSEN to the north. On his return to the ship, KOCH told me that the wolf had followed the sledges faithfully, for about 30 Danish miles, though every evening, when the travellers made halt to settle down for the night, GABRIELSEN shot at the animal. Not till the travellers had shot at the wolf at a very close distance and missed it, did the animal leave the sledges, returning at once to the ship, judging from the time employed.

In the aftenoon March 22nd the wolf ran across the ice at the ship's harbour. Four sledge dogs were encouraged to pursue it. Gradually as the dogs were approaching the wolf, it slackened its pace and at last remained standing defiantly, awaiting their arrival. At this the dogs turned about anxiously, galloping back to the ship.

As a proof of the keen smelling sense of the arctic wolf, the following trail may be mentioned.

On the above named catching place used in January and the beginning of February, a dog's body employed as a bait was still lying on the 24th of March, near the wolf traps. Besides being as hard as a stone, the body was covered with a crusty layer of snow $1^1/_2$ meter thick, and consequently I did not imagine that any beast of prey would be able to find it under the circumstances.

When in the forenoon I walked across to the place, in order to dig the dog's carcass out by means of ice-axe and spade and put the traps right, I found, however, that the snow had been scraped away by the wolf and about half of the dog's meat devoured.

Following the foot-prints I soon caught sight of the wolf which had lain down to rest on a snow-drift, on the other side of a rather small freshwater lake. From an ambush I was able to study the doings of the animal unseen for some time. Now the wolf was lying down on one side with all four limbs outstretched, now it would rise, rubbing itself with one of the hind paws, only to lie down again comfortably on the snow. After having performed its necessities with crooked back exactly like a dog, the animal gave some involontary kicks in the snow with the hind legs, as if trying to hide the excrements, but without succeeding in the least. At last it trudged away slowly along the shore of the lake, climbing on to a low rock, behind which it made itself invisible. The dung of the animal which I examined later on, was black, almost tarred, and mostly consisted of the "pemmican" used as dog's food on the ship, and of tallow (used for the same purpose). Besides I found in the dung some hairs of dogs. (Evidently the last meal on the dug-up dog's carcass had just been eaten and thus not yet digested.)

On March 27th I caught the wolf in a trap. It was a very large, old female of the same colour as the previously killed animals, yet perhaps with a smaller number of dark hairs on back and tail. Even this wolf was extremely emaciated and weighed only 22 kilogrammes.

Length from muzzle to root of tail ..	117	cm.
Total length of the tail	42·5	-
Height from the sole of the foot to the upper edge of the shoulder........	85	-
Circumference (behind the fore limbs)	71	-

On April 4th C. Poulsen returned trom a four weeks' stay at the station at Pustervig. He states to have seen on March 14th perfectly fresh traces of a running wolf (in the valley about 8 kilometer

from the station) and on March 21st a white wolf walking along the foot of the mountain towards Mørkefjorden.

While partaking in a sledge party to the inland ice, Dr. Lindhard saw on Lakseelven March 23rd 1908 fresh traces of a singly walking wolf which had followed the old sledge track of the travellers for a long distances.

On the south end of Hochstetters Forland and on Shannon Island, Jarner found towards the end of April 1908 in several places both fresh and older foot-prints of singly walking wolves.

A highly decayed wolf's cranium was found by Koch and Gundahl-Knudsen on "Varderyggen" northwest of the ship's harbour, about 350 meter over the sea. This cranium which has been brought home to the museum and identified, belongs to a young, hardly full-grown animal. Judging from its appearance that was strongly damaged by time, and the manner in which it was lying, it is easy to infer that it must have remained there for a great number of years. The discovery is so far interesting as it proves with certainty that the point of time for the immigration of the wolf to Greenland must be sought several years further back than hitherto supposed by some investigators.

In the tracts visited by the Danmark Expedition, according to the existing observations the arctic wolf must be sought almost exclusively in localities also affording refuge for larger and smaller herds of musk-oxen, the North-East Greenland wolf being reduced doubtlessly to live most essentially on these animals after the extinction of the reindeer in the country. That the species here — especially in winter — leads a very wretched existence and is going to destruction, if it does not prefer to wander southward to tracts inhabited by reindeer, is probably as certain. In the summer time the wolf will be able to procure his food rather easily, hunting musk-ox calves, lemmings, leverets and brood of birds, besides searching along the beach and on the shores of rivers for the lower animals washed up here, with which he is also satisfied, so far as I was able to conclude from the numerous foot-prints of wolves left in such places.

As above mentioned, the wolf killed in August 1906 was extremely well-nourished, a proof of the abundant food offered in the summer. The emaciated, almost skeleton-like bodies of the animals killed in January, February and March furnished proofs as convincing of the extremely miserable conditions of life to which the wolf is subjected during the long, hard winter.

That in the winter time the wolf should be able to live partly

on arctic foxes and polar hares, is quite at variance with the observations made by me on the subject.

In the winter 1908, while the wolves had their stationary abode near the ship's harbour, the two smaller groups of mountains "Harefjeldet" and "Thermometerfjeldet", situated in the immediate neighbourhood of the harbour, were inhabited by rather numerous polar hares. Though the wolves were strolling about almost daily on the lower parts of these mountains, I never found the least sign of their having tried to hunt the hares living higher up on the rocks. The excellent conditions for tracing the animals, especially in February and March after the cessation of the time of absolute darkness, made it possible for me to make a thorough investigation of the subject, having directed my attention, though under less good conditions, to the same point in other places as well. Yet it may not be excluded that under certain circumstances especially unfavourable to the hare, the wolf may make a prey of it.

Judging from my knowledge of wolf and arctic fox, I feel certain that normally the last mentioned animal will be able to escape being taken by surprise by his stronger kinsman through his caution, quickness and incredible dexterity.

That even in the winter time the wolf is able to gain admission to the lemming by means of his fore paws, I have had occasion to prove several times, and it is just as certain, that the fine scent of the animal will help him to find his way to a carcass very quickly.

On the parts of skeletons of the arctic wolf brought home to the museum, the following measurements have been taken:

Sex.	Age	Date	Designation of place		mm.
♂	ad.	11/1 08	The ship's harbour	Length of the cranium from the hind edge of the occipital condyle to the front edge of the intermaxillary bone	232
				Length of the lower carnassial	32
				The greatest length of the thigh-bone	228
				The greatest length of the upper arm	218
♂	ad.	13/2 08	The ship's harbour	Length of the cranium[1]	234
				Lower carnassial	32
				The thigh-bone	230
				The upper arm	222

[1] The right zygomatic arch has been broken, and the occipital crest has a protuberance, probably deriving likewise from a bruise or blow.

Sex.	Age	Date	Designation of place		mm.
♀	ad.	28/8 06	Hvalrosodden (The musk-ox mountains)	The cranium	231
				Lower carnassial	30
				Thigh-bone	211
				Upper arm	201
♀	ad.	27/3 08	The ship's harbour	The cranium	222
				Lower carnassial	29
				(The remaining parts of skeleton are wanting)	
♀	ad.	5/2 09	Hvalrosodden	Thigh-bone	216
				Upper arm	203
				(The cranium has been put into a stuffed skin)	

The two craniums — ♂ 13/2 08 and ♀ 27/3 08 — have on the upper jaw a third well developed true molar.

Polar bear. *Ursus maritimus* L.

The polar bear was generally to be found at all times of the year as well on the field-ice as in the inlets, more rarely on land. Northernmost the species was met with at lat. 81°7′ n., where Koch's sledge party shot a young she-bear in April 1907. According to the statement of Koch the travelling-party of Mylius-Erichsen is said to have observed a single bear trace at "Danmarks Fjord", consequently still a little more to the north.

As soon as the ship during the passage up came into comparatively tightly packed ice, bears or the traces of these animals were seen daily. The first bear traces were observed on August 2nd 1906 at lat. 75°40′ n. The traces led from a deep lair in the snow which the bear had made near the edge of some up-screwed ice. On August 4th a rather young male bear was shot in the immediate neighbourhood of the ship, and on August 10th a young female, also close by the ship. In the stomach of the latter I found a few leaves of sea-weed; otherwise the two bear stomachs were empty. The killed animals had shown themselves extraordinarily curious and not very cautious, the hunters who were sent out from the ship coming quite close to them without the least difficulty. Judging from the behaviour of the bears it might seem even as if the latter were inclined to attack; with strongly bent knees and sneaking movements they stole away to the edge of the ice, where they were crouching down ready to throw themselves on the boat which came towards them

manned with hunters. — In the interval some more bears were seen from the ship, yet the men did not succeed in coming within shot of any. A she-bear leading her two rather large cubs was thus seen on August 5th. On August 11th in the forenoon a young, rather small bear appeared, and later in the day a female with one cub. During a short landing at Store Koldewey Aug. 13th I observed along the sandy beach fresh traces of a very large bear, and a little higher up on the island — on a snow-drift — traces of a smaller animal. Nearly all the pools of melt water in the pack-ice I found to be surrounded by bear traces. Probably the bear will seek such places to seize upon the fishes and other marine animals which are screwed up to the surface by the current through those cracks in the ice, round which the pools are to be found. With profound care the bears had avoided to tread on the thin new ice which covered the upper part of the water here and there, fearing doubtlessly to cut their feet on the sharp ice-bits. In many places I observed on the snow impressions of the bodies of polar bears. The position of the bears and the locality proved distinctly enough that in such places the bears had been lying in wait for seals. Numerous seals were seen almost everywhere in the pack-ice. (*Erignathus barbatus, Phoca foetida, Phoca groenlandica* and *Cystophora cristata*).

After the arrival of the expedition to its place of designation, my personal observations with regard to the polar bear were few in comparison to those of my sledge-travelling companions, my own activity being mostly bound to investigations on the main land.

As far as I was able to find out from my own observations, compared with the numerous informations which I have obtained through my travelling companions, the polar bear in the here mentioned regions chiefly lives on seals, with which it is able to provide itself at all seasons. Through its excellent smelling sense the animal will also quickly find its way to larger carcasses which it by no means rejects under most conditions. Lower marine animals the bears will seek along the shores and near the open cracks in the ice. (In the stomach of a bear I found besides the remains of seals also some rests of crabs.) The vegetables growing in the country do not seem to please it. Sure enough I found in some cases grass and other rests of plants in the stomach of the bear, but only in such an insignificant quantity that it might seem as if the vegetable matter had been swallowed together with food of another kind.

Pairing took place in the end of April and the beginning of May. As a rule the young were born in February and March and

followed the mother for about one and a half year, sometimes perhaps a little longer. Most frequently the polar bear had two cubs at a time. In 25 cases it was stated that a litter contained two cubs, in ten cases only one. The young were watched with the greatest care by the mother which also taught them how to catch seal. With exception of the time when the she-bear was pregnant with her cubs, and the pairing time, the bears were wandering about singly, strolling far and wide on hunting excursions. I was not able to trace any regular wanderings, neither did I observe any hybernation proper with the species. The bears were strolling about all the year round. Yet I believe that for a short time, before and after the birth of the young, the she-bear will remain quietly in her dwelling. The latter was to be found deeply buried in masses of snow on the ice, near some larger ice-berg or among big blocks of ice. Even the male bear would sometimes make holes in the snow where he remained for some days in the winter, especially in hard weather. Often the bears returned to such dens, when their hunting excursions were finished.

As a rule the polar bears showed themselves very curious, and sometimes they might be rather forward. This seemed to be the case especially with the younger males. Yet most of the bears which were seen, might be considered rather cautious, some of them — chiefly the dams accompanied by their cubs — were even very shy. Some bears were killed at the ship's harbour, close by the ship, having been enticed there by the meat provisions on board. Yet the greater part of the bears killed on the expedition originate from the sledge journeys. During the latter the bear hunting was carried on in the following way: some sledge dogs were let loose to run the bear in and keep it at bay, till the hunters were able to shoot it down at a very short distance. In order to escape the impudence of the dogs, the chased bear would often barricade itself on the top of the nearest ice-berg. Not rarely did the bears choose to retire to the mountains, in which case it was extremely difficult to carry on the pursuit.

On the whole 64 bears were killed: 34 males, 18 females and 12 cubs.

After this resumé I shall render in condensed form the most important observations and events concerning the polar bear in the succession in which I have put them down.

On a chartographic expedition to Kap Marie Valdemar and environs from Aug. 15th to 27th 1906 two bears were shot — both males, an old and a younger one. One of these bears fled to a smaller freshwater lake, where Koch killed it with a shot of his revolver.

15/9 06. MYLIUS-ERICHSEN shot a young male bear near Stormbugt. While M.-E. was occupied with the excavation of an old Eskimo dwelling on the beach, the bear came trudging curiously quite close to him.

In the night a bear came close to the ship and afterwards to the houses on the beach. The sledge dogs at once surrounded the bear with a deafening barking and howling. Wounded by the rifle ball of the night watchman the bear at last fled to the mountains, where the hunters were unable to pursue it on account of the darkness.

22/6 06. A young male bear came walking on the thin new ice up to the ship, strolling about in the neighbourhood quite fearlessly, till it was shot. It was proved later on that the bear had folloved the traces of a man for a long distance up to the ship's harbour.

On a sledge expedition to Koldewey Islands from October 25th—31st 1906 two bears were shot, a very large old male and a younger male. At the same time a she-bear was seen, accompanied by one cub. The animals followed the coast for some time, till at last, harassed by the hunters and the dogs, they laid their course across the country, where they stood watching their pursuers from the top of a mountain, 1000 meter high, Traces of other bears were seen, partly on the ice and partly on a glacier.

10/11 06. A sledge expedition returned from a journey southward. G. THOSTRUP stated to have seen a she-bear with two cubs. Judging from the traces the animals had been staying several days near a broad open crack seal-hunting. (A seal was seen lying on the ice near its breathing hole.) The bear was very timid as usual when it is accompanied by young ones.

4/11 06. At Hvalrosodden BRØNLUND shot a she-bear and her cub, about half a year old. The bears came from the bay, making straight for the headland, where some remains of shot walrusses were lying, having evidently been visited by bears before. Even this she-bear was very shy and fled with her cub as soon as BRØNLUND made his appearance. His sledge dogs however soon ran both the animals in, after which BRØNLUND walked quite close to them and shot them.

5/11 06. At the ship two bears appeared early in the morning — a female with her cub, half a year old. The dogs at once surrounded the animals which were killed close by the ship's side. The two bears were very emaciated. That a she-bear with her cub will venture so close to human beings proves that they must have been very hungry. Many miles to the nearest open water. The stomachs of both animals were perfectly empty. The teats of the

dam were surrounded by frozen milk which had trickled out from the cub's mouth while it was sucking.

$^{23}/_{11}$ 06. Three bears — mother with two large cubs — came close to the ship during the night. While the young bears were fighting the dogs violently, the old one walked quite close to the ship's side. From the ship some shots were aimed at the bears, yet without much effect on account of the darkness. Pursued by some dogs the family of bears at last fled across the country and further on to the sea-ice.

$^{5}/_{12}$ 06. A sledge expedition returned from a 22 days' journey to Shannon Ø and Sabine Ø. On the journey four bears were observed, two of which were shot. The first, a young male, was killed $^{14}/_{11}$ at the edge of an open crack in the ice, 2 meters broad and very long. A great number of bear traces were observed along this crack; doubtlessly many seals resorted to the place. When the travellers again passed this spot on their journey home, they shot here ($^{2}/_{12}$) an old, very large male bear. This bear had just caught a seal in its dwelling under the snow, sheltered by a rather large bulk of up-screwed ice. Of the seal the skin and blubber down to the hind flappers had already been devoured. The bear had dragged the remains of his prey away to an ice-berg 30 meters from the seal's dwelling, on the lee side of which large masses of snow were deposited. In the firmest parts of the snow the bear had with his fore paws cut out some large, regular blocks, carefully hiding the remaining seal meat with these. On a lair scraped up in the snow the bear was lying, keeping watch over his "depot".

The two bears here mentioned were shot off Haystack.

On the journey home the travellers made halt at Teufelkap, where a depot of provisions and dog's food was placed. Round the depot several foot-prints of bears were seen, among others the traces of a female with two rather small cubs, yet hardly less than half a year old. The bears had carefully examined the whole depot, eaten half of the dog's food (dried fish) and made an unsuccessful attack on the provision chest which was lined with tin inwardly. Deep marks of the animal's teeth were left all over the chest which had been moved away several meters from its original place. A marking pole had been pulled down and broken.

$^{29}/_{12}$ 06. A rather old male bear was shot in the neighbourhood of Hvalrosodden. The hunters were staying in the tent, when the dogs, barking violently, ran out on the bay dragging the sledge after them. About two hundred meters out on the bay the bear was found, barricaded near an ice-berg and surrounded by the dogs.

This bear was uncommonly meagre. The stomach contained bits of skin and blubber of seal (*Phoca foetida*) besides some pieces of rope. At the mouth of the large, frozen river "Lakseelven" in the neighbourhood of Hvalrosodden the bear had made a deep, cosy lair in the snow by the side of an ice-berg. The traces showed that for some time the animal had been walking to and from this couch. Among other places the bear had sought its food on the headland where some walrus carcasses were lying. That seals are to be found however even in the middle of the winter in the depths of the inlets is proved by the newly mentioned examination of the bear's stomach.

$^{22}/_{1}$ 07. Fresh bear traces were seen at the edge of a rather large hole in the ice, about 15 kilometer east of the ship's harbour.

$^{26}/_{1}$ 07. Near the same opening which had now been considerably narrowed, the traces of two bears, a larger and a smaller one which had accompanied each other, were seen. Probably it has been a female bear with her cub. The traces were leading landward and further on across the mountains.

$^{13}/_{2}$ 07. On "Stormbugt" a bear was shot, a younger male. Pursued by the dogs the bear climbed the utmost top of a mighty iceberg. The skin of this bear was strikingly yellowish. The animal was very emaciated. The stomach contained a few rests of plants (grass), swallowed perhaps together with some smaller prey, caught on land. I found the lair of the animal at the edge of an ice-berg near the coast. This lair was made in the snow which had drifted together, and consisted in a circular recess $1^{1}/_{2}$ meter in diameter. The snow blocks which the bear had cut off, had been heaped up with great precision on one side of the recess.

$^{16}/_{2}$ 07. One of the Greenlanders shot a rather large male bear near the ship. The bear was surrounded by a great number of dogs. This bear was in excellent condition, and its coat was dazzlingly white. The teeth were very yellowish. As the dogs threw themselves furiously on the body of the bear directly after the flaying, it was impossible for me to examine the contents of the stomach.

$^{28}/_{2}$ 07. On a north-going sledge drive from $^{20}/_{2}$—$^{28}/_{2}$ a young male bear was shot in the neighbourhood of Kap Amélie. Traces of a female with two large cubs were seen at the same place. Moreover the travellers found near a depot fresh traces of a bear which had tried to open some provision boxes.

$^{10}/_{3}$ 07. A young, lank male bear was shot near the ship. With exception of a few rests of vegetables the animal's stomach was empty.

12/3 07. A rather large, probably about three years old male bear was shot close by the ship. The stomach empty. The liver of this bear was fried and served on board. Shortly afterwards all the partakers in the meal became ill, some of them even rather seriously. (The symptoms and course of this malady has been explicitly treated in the statement composed by the physician of the expedition, Dr. LINDHARD).

18/3 07. Traces of a bear accompanied by two quite small cubs were observed north of Kap Amélie c. lat. 77°50′ n.

21/3 07. At the southern point of Lille Koldewey BRØNLUND came across a young female bear with two small cubs, probably about three weeks old. BRØNLUND at first shot the dam, then he took one cub under the arm and was just hastening to save the other from the attack of the dogs, when the mortally wounded she-bear rose up with a last exertion to defend her offspring. Now the hunter was obliged to release the cub in order to do away with the mother. In the meantime both cubs escaped, one to each side. The darkness having fallen at length, BRØNLUND gave up looking for the two poor helpless animals after three hours' eager searching. The dogs refused to do anything in the way of searching, meaning no doubt that they had got abundant compensation for their efforts in the killed bear. The size of the cubs is stated by the narrator to be like that of a young polar hare. The killed she-bear was very emaciated. The stomach was empty. Round the hindmost pair of teats some frozen remains of milk were left. The foremost pair had not been used.

23/3 07. In the mountains north of the ship's harbour a young she-bear and her two yearling cubs were shot. All three animals were extremely emaciated. The stomachs of the young were empty. In the stomach of the dam some rests of vegetable matter (grass) were found.

23/4 07. During the last days I have observed numerous bear traces in Stormbugt and Dove Bugt. JARNER saw a rather large bear at Koldewey Islands. The observer approached the bear at a distance of 50 steps, but his only weapon being a revolver, he did not think it advisable to make a closer acquaintance with the bear, and so they went their way separately.

Dr. LINDHARD found near the field-ice fresh traces of a singly walking bear, besides those of a female with two small cubs.

1/5 07. A she-bear accompanied by two large cubs came walking towards the ship early in the morning. In the company of a friend I went down on the ice to receive the bears. As we had stretched ourselves out flat on the ice, the animals at first took us

to be a couple of seals and made straight for us, sniffing with their noses in the air. The mother however soon took alarm and tried to make the curious cubs turn round, pushing and kicking them continually with her fore limbs. When the bears were about two hundered meters away from us, they all rose up on their hind limbs. Raising the muzzles straight in the air and sniffing in different directions, with the fore limbs swinging forewards and backwards, the beautiful animals came wandering slowly towards us. Suddenly the old bear stopped suspiciously for a few seconds, after which she quickly walked away, hiding herself behind a large ice-block in the neighbourhood. The cubs wandered on a few steps more, then even they caught alarm and walked behind the ice-block. When we set out for the latter, hoping to be able to kill the three bears at a very close distance, we saw to our disappointment the animals fleeing at full speed towards the sea-ice. We aimed a shot each of us at one of the cubs which was severely wounded. Soon it was not able to keep up with the others and showed inclination to lie down. When the dam which had watched the movements of the wounded cub with great attention all the time, observed this, she came hurrying back to the cub in long jumps, making it resume its flight through violent blows with the fore limbs, nudging and pushing it on. The cub was still bleeding strongly, and it proved too weak to obey the directions of the mother closely. It was not able to follow her up over the low rocks along the coast of Kap Bismarck, the retreat being therefore laid once more to the less uneven ice-fields. In spite of the greatest exertions we were not able to follow the bears which got ahead of us more and more, disappearing at last far out on the sea-ice among the innumerable ice-blocks there.

The three bears were very nearly of the same size.

3/5 07. On "Stormbugt" FREUCHEN saw a she-bear with two large cubs.

9/5 07. This morning I shot a rather large male bear on the sea-ice in the neigbourhood of Maroussia.

When I was camping out here, I observed numerous traces of bears, also of she-bears accompanied by their cubs, nearly always two in number. On the newfallen snow outside the tent the traces of an uncommonly large bear was seen. (The breadth of the hind paw 28 cm., the length 35 cm.)

The Greenlander HENDRIK came home from a sledge drive to Kap Amélie, carrying with him a very large male bear. While HENDRIK was asleep in his little tent during the night, the bear came and put his head inside the tent door. With some small shot

in his face the bear quickly retired, after which HENDRIK ran out and gave the bear his rest with a rifle ball.

$^{12}/_{5}$ 07. Since May 9th 6 bears — among which a female with two small cubs — have passed the ice between the ship and Maroussia. The tracing conditions excellent.

$^{21}/_{5}$ 07. At Kap Bismarck an old male bear was shot by KOEFOED and JENSEN who saw another bear a little farther out on the ice.

$^{2}/_{6}$ 07. On the ice not far from Stormkap I observed last night three bears — a female with her two almost full-grown cubs. At my arrival the bears fled from a partly devoured seal (*Phoca foetida*), round which appeared likewise some sea-gulls (*Larus glaucus*), two ravens and two foxes. Both the birds and the foxes were incredibly impudent. Thus a sea-gull went on snatching at the outhanging guts of the seal at the same time as the bears were devouring skin and blubber of the welcome prey. Evidently very much against their will the bears left the place before I came within suitable shooting distance of them, trudging slowly across the bay, till they remained standing, partly hidden behind an iceberg, and kept an eye on me. An attempt of getting a shot at the animals would be hopeless under the conditions. I remained hidden near the seal's carcass for a couple of hours, but the prudent animals did not seem inclined to return to the latter.

Through closer investigation I found that the bears had killed the seal at its "breathing hole" in the ice. The tracing conditions were so good that the whole situation might be constructed without difficulty. Three impressions of the bodies of the bears, one directly behind the other, showed that the animals had been lying in wait for the seal at the lee-side of the breathing hole. The latter was surrounded by a layer of snow 75 cm. high, and in this way it was no easy matter for the seal to swing itself up through the hole. Judging from the size of the impressions, the old bear must have been lying nearest to the hole — at a distance of about two meters — and the cubs behind her as lookers-on. In the moment when the seal with great strength forces the fore part of its body up through the funnel-shaped hole, the mighty fore paw of the bear hits it on the head. On the snow distinct marks were left of the leap and the claws of the bear which had scoured hurriedly across the snowy plane on the opposite side of the breathing hole. The shivered skull of the seal was lying close to the latter. (At my arrival the bears had dragged the remains of their prey fifty meters away from the hole.)

The impressions in the snow proved that the bears had been

keeping watch for a long time at the seal's breathing hole. — The observation took place in the night, but the radiant midnight sun and a good telescope nevertheless permitted me to watch the doings of the animals closely.

Later on the same three bears were constantly seen on Stormbugt and Dove Bugt in pursuit of seals, till at last they were all shot July 6th. One of the cubs — a male — was then nearly of the same size as the mother, the other (a female) was somewhat smaller.

13/7 07. A she-bear with one small cub was seen on the ice east of Kap Bismarck.

5/8 07. When I went on shore at Hvalrosodden in the company of some comrades, we here saw a large male bear which was devouring a walrus carcass lying on the headland. The bear was so occupied with his meal that he hardly heeded our arrival, and it was therefore an easy matter for us to shoot him down. It was evident that the bear had been staying for a long time near the carcass which he had hollowed out to such an extent that he was standing partly hidden by the remaining, putrid walrus skin while devouring the internal parts. The bear had made a deep lair in the sand in the neighbourhood of his pantry. From this couch he has probably kept watch over the carcass. At our arrival the bear was surrounded by great numbers of sea-gulls (*Larus glaucus*), ravens and some foxes. Some traces of wolves were also leading to and from the place.

This bear was extremely fat, and his fur had a strongly yellowish tinge. The hairs on head and neck had rotted off partly through the animal's constant raking up in the big carcass. (I have noticed similar cases with arctic foxes and wolves which have visited some large carcass for a length of time.)

6/10 07. Johansen shot a younger she-bear at Renskæret. The bear was very fat. The stomach contained some small stones and a few rests of vegetable matter.

Ring came home from a sledge drive to the north. He carried with him a male bear, shot 12 kilometer north of Kap Amélie.

27/10 07. Great numbers of bear traces have been found the last days between Kap Bismarck and Renskæret; among others I saw the traces of a female with two cubs and of another female, accompanied by one cub.

22/10 07. Bistrup states to have seen a bear on Edvards Ø. The bear fled, leaving behind it a killed seal which it had dragged from the ice up on a 20 meter high brlnk. (An arctic fox was strolling about in the neighbourhood.) Several seals were seen lying

all round the ice. The waters south of the island were filled with large ice-bergs surrounded by thin new ice.

On the way from the Teufelkap island to the west end of Lichts Ø Bistrup saw $^{26}/_{10}$ a bear with two cubs (about half a year old). Occupied in playing with her cubs the bear did not heed the sledge, till it had advanced quite close to the animals. Some unharnessed dogs at once set out in pursuit of the bears which turned round and ran towards the coast and farther on across the mountains. When the dogs came nearer, the she-bear made the cubs run before her, while she remained behind to take up the combat. Soon the bear was surrounded by the dogs and killed by a rifle shot. The young however were lost of sight and did not show themselves for some hours. At last one of the bear cubs appeared near the place where the mother was killed, still extremely cautious and ready to turn round as soon as it was in the least scared. Bistrup harnessed the dogs to the sledge and pursued the cub 7—8 kilometer. A dog which had been let loose soon came up with the bear and kept it at bay, till Bistrup came and shot it. Next day in the morning the second bear cub appeared at a distance of about 700 meter, standing on the crest of a small rock and sniffing cautiously towards the tent. It was pursued, but in vain. The animal at once fled and did not appear any more. The stomachs of the two killed bears contained seal.

During my absence a cub of about 5 months was shot on Aug. 13th 1907 at “Syttenkilometernæsset”. The animal walked alone and was in good condition. After the statement of the narrator the stomach contained meat — not of seals. It seemed strange to me that a bear of that age was strolling about alone and that it had managed to keep up life under such conditions. That the animal — as some supposed — should be identical with one of the very small cubs (described under $^{31}/_{3}$ 07), the mother of which was shot by Brønlund, is quite contrary to to the laws of nature in my opinion. How should a bear’s cub of three weeks, left to itself in the coldest month of the year, when everything is covered with ice, be able to sustain life?

$^{2}/_{11}$ 07. Not far from the ship’s harbour Tobias shot a rather young she-bear. The bear was very fat. The teats were quite small, and the animal contained no foetus. — The stomach empty.

Record from G. Thostrup’s and Wegener’s sledge drive from the ship’s harbour to lat. 80° 45′ n.

March 28th—May 31st 1907.

12/4. 12 kilometer from Lamberts Land the traces of a bear with two small cubs going eastward were seen on the bay. Following the traces the travellers found the animals in a 6 meter deep snow cave; at the inmost part of the latter was a 50 cm. broad hole leading down to the water, probably the breathing hole of a seal.

At the arrival of the hunters the she-bear defended herself violently at the entrance to the cave, while the young remained behind. The mother was shot, and the cubs which were supposed to be three weeks old, were bitten to death by the dogs.

In the evening, the travellers having pitched their tent on the ice 16 kilometer north of Lamberts Land, the dogs surrounded a rather old male bear which was shot near the tent.

15/4 07. Lat. 79° 45′ n. A male bear was seen on a glacier and shot.

16/4 07. Lat. 79° 50′ n. A bear with two small cubs (of the same size as those mentioned under 12/4) was seen, surrounded by the dogs and shot. The same day, while the travellers were busy flaying the killed bears, a very large male bear approached the tent, coming from the north. The dogs immediately set out in pursuit of the bear which ran towards the coast jumping quickly (each jump was of the length of 4 meters). Now and then the bear turned round and faced the forward dogs, till at last, strongly harassed by the latter, it jumped on to a 15 meter high ice-berg, from the top of which it was shot down.

21/4 07. Lat. 80° 10′ n. A younger male bear was ran in by the dogs and shot.

9/5 07. Lat. 80° 10′ n. On the sea-ice two bears were observed, always keeping close to each other. A little nearer to the sledge a young male bear suddenly appeared and was soon shot. Nevertheless the two bears that were walking on the ice at some distance, still remained close to each other, often wandering round in small circles, touching each other with the muzzles at the same time. Evidently it was a male and a female pairing. When the dogs became aware of the bears and set out in pursuit of them at full speed, the male bear prompted his companion to escape, slapping her with the fore limbs; now and then he put himself in a posture of defence, when the dogs became too forward. The she-bear having been severely wounded by a ball which made her unable to escape, the male hurried to her rescue, furiously defending her against the attack of the dogs. When even the male was severely wounded, both bears roared hoarsely and became quite furious with pain. They rose up on their hind limbs, swinging the upper part of the body against each other and slapping each other violently with the fore paws. After

the lapse of a few minutes the hunters succeeded in killing the two bears.

The exterior sexual organ of the female was highly swollen, and the observers felt convinced that pairing had taken place quite recently.

When the hunters were loading the killed bears on the sledges, a bear came walking towards them from the perfectly flat sea-ice. Even this bear, an uncommonly large, old male, was shot.

No less than 4 adult bears were thus shot at the same place. It must be supposed that the two male bears which were not seen in company with the female, have been enticed by the latter all the same.

Somewhat nearer to the coast the travellers came across some seals lying on the ice.

18/5 07. Lat. 79° 50′ n. The traces of two adult bears were seen on the frozen sound. The animals had been walking together for a long distance. Undoubtedly it must have been a male and a female (the traces were not of the same size) on their pairing trip.

25/5 07. Lat. 78° 13′ n. Numerous bear traces at the provision depot here. The provision boxes were covered with deep marks of bear's teeth. The other objects that were placed in the depot had all been perfectly dispersed by the bears.

Record from Koch's journey to the north.

28/4 07. Lat. 81° 7′ n. A rather young she-bear with milk in her teats was shot on the ice 3—4 kilometer from the coast.

6/6 07. Lat. 80° 57′ n. An old male bear shot on the ice. Seal in the stomach. The remains of a seal were lying on the ice.

Later on fresh traces of a bear was found on the ice. The bear had dragged a killed seal over a distance of 500 meter. (A fox was standing near the carcass.)

15/6 07. Lat. 78° 30′ n. Great numbers of bear traces here as on the journey up.

At "Nordre Depot" a great many bear traces were observed.

Record from Jarner's journey from May 10th til June 20th 1907.

22/6 07. The southern estuary of Dove Bugt is filled with large ice-bergs. Numerous bear traces were observed everywhere, now and then leading up over the ice-bergs. Among the traces footprints of female bears with their cubs were often to be distin-

guished. A she-bear with one little cub was seen in this territory. On the ice many breathing holes of seals were observed.

$^{24}/_{5}$ 07. A smaller bear was seen on the ice among the islands near Teufelkap. The observers lay down flat on the ice, and the bear now seemed inclined to attack. With strongly bent knees and a slinking, though quick gait it made right for the men, till suddenly it turned round and took to its heels, wounded by a ball.

$^{28}/_{5}$ 07. The sledge party arrived at Kap Peschel to take in supplies of provisions from the depot there. The provision chest had been bitten to pieces by bears. The stores in tin boxes — with exception of tea and sardines — were devoured, and the empty boxes scattered to the winds. The petroleum jar had been upset and its contents spilled.

$^{30}/_{5}$ 07. At the depot on Koldewey Islands the bears had made an unsuccessful attack on the provision chest. A bundle of dried fish on the contrary had been devoured.

$^{2}/_{6}$ 07. On the west side of the island a bear with one small cub had walked up to the tent. A young she-bear was shot outside the tent. The stomach contained remains of seal.

$^{2}/_{1}$ 08. P. HANSEN observed fresh bear traces on Dove Bugt. The bear had followed the old sledge track for some time.

$^{18}/_{2}$ 08. B. THOSTRUP saw in Bessel's Bay traces of a rather large bear. The traces were leading up across the low country.

$^{5}/_{3}$ 08. A young she-bear was shot at the metereological station at Pustervig. The bear was very emaciated. The stomach empty. No foetus. The teats small.

$^{18}/_{3}$ 08. A large she-bear with her yearling cubs was seen on the inlet-ice off Koldewey Islands (TROLLE, JOHANSEN and HAGERUP). Many bear traces among the innumerable, large ice-blocks. Near one of the latter the observers found that the snow had been intersected by a bear. On carrying the excavation further, they came across a seal's dwelling and a seal's breathing hole.

KOCH's and GABRIELSEN's journey to the north from March 10th—26th 1908.

$^{10}/_{3}$. Traces of a rather large bear on the sea-ice some 20 kilometer north of the ship's harbour. Open water at some distance from the coast.

$^{11}/_{3}$. 60 kilometer north of the ship's harbour one quite fresh bear trace and another somewhat older. Some open water still remains.

$^{14}/_{3}$. Lat. 78° n. Bear traces — a female with two very small cubs.

A little afterwards traces of a female with two small cubs was again observed. All the traces on the ice (the outside of the islands).

$^{20}/_{3}$. Lat. 78° 55′ n. Fresh traces of a bear with two small cubs.

South of "Schnauders Ø" fresh bear traces were seen twice — in both cases belonging to a female with two small cubs.

Several bear traces a little more to the south.

Dr. LINDHARD states to have seen on April 17th 1908 fresh traces of a bear far out on "Sælsøen". The traces seemed to start from the inland-ice, going outward across the lake.

Record from JARNER's sledge drive to the south in the spring 1908.

$^{16}/_{4}$. Traces of a she-bear with two very small cubs in the neighbourhood of Teufelkap.

After the opinion of the narrator a great many bears have their stronghold west of Teufelkap before "Brede Bræ". The territory here offers the most excellent localities and is extremely rich in seals.

$^{17}/_{4}$. 2 bears — male and female — were shot. The bears were seen before that time wandering close to each other. Judging from the sexual organ of the female, pairing had taken place recently.

The stomachs of the animals contained rests of seals; one of them a seal-foetus.

$^{19}/_{4}$. A large male bear and a smaller female were seen together. When the dogs were approaching the bears, the male drove his companion towards the coast, while he himself attacked his pursuers. A single dog kept the she-bear at bay on an ice-berg for about an hour. Both bears were shot.

In several places parallel foot-prints of two adult bears were seen (pairing?).

$^{25}/_{4}$. Traces of five different bears were seen on the ice. (A seal was lying on the ice near its breathing hole.)

(The ice here breaks up several times, even in the middle of the winter.)

$^{3}/_{5}$. 2 bears — male and female — were shot. The female was small and emaciated, the male large and fat. The stomachs empty.

$^{4}/_{5}$. A large male and a small — probably two years old — female were shot. The bears were coming from the open water. The sexual organ of the female betrayed pairing.

$^{7}/_{5}$. A bear was seen.

$^{8}/_{5}$. A large male bear shot.

$^{9}/_{5}$. A small one year old bear shot.

(JARNER's journey proceeded west of Store Koldewey and farther southward along the coast to Ardencaple Inlet and Shannon Ø.)

Ermine. *Mustela erminea* L.

In Greenland the ermine as well as the lemming, on which it almost exclusively lives, is bound to the northernmost and north-eastern parts of the country.

About the appearance of the species in the country comparatively scarce informations exist however, and of Greenland ermines — according to "Grønlands Pattedyr" by H. WINGE — no more than seven specimens had been collected until the year 1902 — 6 from the east coast, 1 from the north coast.

Though surely the ermine does not appear in great numbers anywhere in Greenland, yet it is hardly so rare as might be expected according to the investigations hitherto made.

The ermine is in Greenland a rather obstinately stationary animal which will only now and then wander some distance away from the once chosen hunting ground. Thus the observers are obliged to await the appearance of the animal here. As a rule this demands rather a good deal of time and patience. Add to this that in winter the Greenland ermine will be stirring about very little altogether in the open air. Otherwise at this season the animal would most easily betray its presence by the traces left on the snow. — Probably these circumstances may explain the reason why the species has been able to escape the attention of former travellers to such an extraordinary extent.

In the tracts visited by the "Danmark Expedition", the species must be considered rather common, though it did not appear in great numbers anywhere. Ermines or sure signs of their presence were met with in many places, yet most frequently in the tracts where thorough and continuous investigations were made possible, as for instance in the territory near the ship's harbour, and at the metereological station at Pustervig.

No less than nine adult animals, shot or caught at different times of the year, were brought home.

Localities especially attractive to the ermines were the low coast mountains west of the ship's harbour, as well as the two mountain

groups Harefjeldet and Thermometerfjeldet which were likewise situated in the neighbourhood of the harbour. Six of the animals brought home originate from these places.

Moreover the species was to be found where suitable locality was offered, as well along the shores as in the interior of the country. Only on the smaller islands I never found the animal, even when they were inhabited by great numbers of lemmings.

On "Dronning Louises Land" — 40 kilometer up on the inland ice — LINDHARD saw on March 14th 1908 some traces of ermines. The same locality was rich in lemmings. During the return journey from the inland ice, LINDHARD found four days later fresh traces of an ermine which had crossed the inner part of Sælsøen, where at the same time traces of some singly walking lemmings were seen. Owing to the unfavourable conditions for the observation of ermines, under which the chartographic sledge expeditions to the high north took place, the informations gained about the presence of the species here were extremely scarce.

On the southern side of "Orleans Sundet" — lat. 77° 45′ n. — KOCH found on March 24th 1908, among some down-fallen rocks $1^1/_2$ kilometer from the coast, fresh traces of an ermine. With exception of this observation no sure evidence of the presence of the ermine was perceived by the north-going sledge expeditions, these being confined almost exclusively to the ice, with short stays here and there in the adjacent coast country. Whether the travelling party of MYLIUS-ERICHSEN has observed the species in the tract round "Danmarks Fjord", is not known. In the diary left by BRØNLUND it is not mentioned.

As before indicated the Greenland ermine chiefly lives on lemmings, being able to pursue and kill the animals in their subterranean passages. During the coldest winter time, especially while the sun is under the horizon, both animals lead a hidden existence.

Only in very rare cases a lemming will appear at this time on the surface of the snow, and the ptarmigans and snow-buntings which the ermine is fond of hunting when the weather is fine, have left the country.

In winter the lemming especially resorts to large, firmly deposited masses of snow which are highly isolating from the cold, and in such places the ermine digs an almost perpendicular passage, through which it makes its way to the border between the snow and the surface of the earth. Here the lemming is generally strolling about, and here the ermine is able to follow its paths without difficulty. Sometimes the same ermine will provide itself with two or three holes for its descent, placed in different parts of the snow-

drift; when the latter is not too large in extent however, the animal will content itself with one hole which is disposed as far as possible in the immediate neighbourhood of the mountain wall or heap of stones, where the proper dwelling of the ermine is hidden. The holes made by the ermine in the snow are always considerably larger than those of the lemming.

Until the ptarmigan makes its appearance towards the middle of February, the wanderings of the ermine above the ground are mostly confined to the short stretch from the dwelling to the hole, through which it descends, and vice versa, and weeks may pass away without its leaving any traces elsewhere.

The hair covering of the ermine being much less adapted to the severe cold of winter, than that of any other arctic terrestrial mammal, the animal would fare very badly, if it were to remain in the open air for a longer time during the coldest season of the year.

As a proof of the animal's want of capacity to resist the cold, the following observation may be stated.

On April 24th 1907 I placed on the northwestern slope of Thermometerfjeldet an ermine trap — a square box of deal-wood, 110 cm. long, 20 cm. broad, with a dead ptarmigan for a bait. When I came to look at the trap 24 hours later, it contained an ermine in full winter dress, frozen to death. The animal was lying in a tightly rolled-up position, covered with ptarmigan feathers which it had plucked out most carefully, making a globular bed for itself. About one third of the ptarmigan was devoured. The lowest temperature of the night had been ÷ 18°; it had been blowing rather hard in the night however, and some snow had drifted together and was accumulated all around and on the top of the trap, the latter being yet free from snow in one end which was only closed by an iron grating.

In a similar trap I found on March 18th 1908 an ermine in winter dress, likewise frozen to death. Even this animal had been sitting in the trap for about 24 hours, yet surely under far more severe conditions than the above mentioned specimen, the temperature being in this last case about ÷ 30°, but without any wind. As a bait I had this time used a hard frozen rat which was lying quite untouched, without having been able to afford the imprisoned ermine the least shelter against the cold. A polar hare or arctic fox would have been able to sustain life for a long time under similar conditions, supposing of course that the animals had been provided with sufficient food during their imprisonment.

Gradually as the sun appears over the horizon and the passage

of the ptarmigan begins, the ermine will make little excursions along steep mountain sides, across heaps of stones and smaller stretches of meadow land and up through partly snow-filled glens, often following the track of the ptarmigan. Yet these wanderings are rarely extended to more than about one kilometer, or a little more, and the ermine quickly returns to its hole in the hard frozen snowdrift or to its cosy dwelling among the down-fallen stones. The lemming which will also venture out in the light now and then, is still the most important, not to say the only prey of the ermine.

Fig. 21. Typical ermine locality. March 1908.

As far as I was able to judge, the pursuit of the ptarmigan was namely carried on more as a kind of sport than as a useful chase, and probably it is a mere chance when the otherwise so dexterous little beast of prey succeeds in catching a grown-up ptarmigan. The same may be said about the hunting of full-grown snow-buntings which I have seen the ermine pursuing in vain several times.

Without being able to found my opinion on any positive observations, I still feel certain that the Greenland ermine is a no less dangerous enemy to leverets and broods of birds than the European one.

In the summer time at any rate the animal will stroll about very much in the open air, though, as before mentioned, it does not often wander far away from its stationary abode.

In manners as in appearance the ermine in Greenland is very much like the European animal. Curiosity and a strongly marked taste for merry diversion characterizes the nimble and graceful little animal. When the weather was fine, most frequently in the late afternoon hours, I often saw it playing outside its dwelling which was generally to be found among heaps of stones lying close to low, perpendicular mountain walls. In the traps set up by me, where I used shot ptarmigans, snow-buntings or rats — the latter being present in great numbers on board the ship — as a bait, the ermines would appear more out of curiosity than just to satisfy their hunger. As a rule the captive animals would content themselves with eating the brains of the birds that were laid out; the rats they did not touch. Even in captivity the ermines showed an extraordinary fearlessness, and in spite of my presence they would often lie down close to the grating of the trap, enjoying the heat of the sun with half-closed eyes. Only when I was rummaging too much with the trap, the prisoner showed his displeasure through a loud hissing.

No young or not quite full-grown animals were seen.

As far as I was able to judge from the sexual organs of the killed animals and from other circumstances, the pairing takes place in the end of March. I was not able to ascertain if the two sexes keep together all the year round. The fact that at most times of the year I only found traces of singly walking animals, might seem to prove the reverse.

In the beginning of May the white winter dress is changed for the summer dress which is somewhat more short-haired. A big, probably very old male, killed on May 3rd 1908, already wears the summer coat. On this specimen the latter has on the upper side a greyish brown colour with a faint bluish tint; on the under side it is white with a greenish yellow touch on the neck and the upper part of the breast. Long, white hairs from the winter dress are still to be found along the sides, on the belly and the tail.

A young, very small female from May 21st 1907 is in full summer dress: the upper side brown, the under side white with a faint touch of yellow.

Adult male from August 17th 1906 in full summer dress: strongly faded, tawny upper side, the under side white with a stronger, sulphur-coloured tint.

Adult male from Septbr. 4th 1906 is in summer dress as well, commencing to shed his coat along the left side: Strongly golden brown upper side, faintly yellowish under side.

After the middle of September the animal again appears in the

white dress. Thus a female from Septbr. 19th is in full winter dress. When the animals wear the white dress, the soles of their feet are extremely hairy, this being the case especially with the hind paws, where the pads are completely concealed by woolly hairs.

On the ermines brought home to the museum — 5 males, 3 females — the following measurements have been taken:

	18/3 08 ♂ ad. Harefjeldet	17/8 06 ♂ ad. Harefjeldet	3/5 08 ♂ ad. Harefjeldet	10/4 07 ♂ ad. Rock near Baadskæret	1/11 07 ♂ ad. Pustervig	19/4 07 ♀ ad. The ship's harbour
	mm.	mm.	mm.	mm.	mm.	mm.
Length of the row of upper cheek teeth	11	11	11·5	11·5	12	10
Length of upper carnassial	5·5	5	6	5·5	6	5
Length of the row of lower cheek teeth	13	12	14	13	13·5	12
Length of lower carnassial............	6	5·5	6·5	6	6.	5
Length of the cranium from the hind edge of the condyle to the front edge of the premaxilla	47	46	47·5	46	46	43
The distance between the orbits	13	12	13	13	12·5	11
The distance between the temporal fossæ	12	11	11	12	10·5	10
Width across the zygomatic arches....	28	25·5	28	26	27	25
Width of the cranium................	23·5	24	22	23	22	20
Length of the lower jaw from the hind edge of the condyle to the front edge of the chin	26	25	25·5	26	26	23
Length of the tail from the anal opening to the utmost tip (measured on the flayed bodies)	83	83	83	83	77	74

Measurements taken on complete animals in spirits:

	4/9 06 ♂ ad. Harefjeldet	25/4 07 ♀ ad. Thermometerfjeldet	21/5 07 ♀ ad. Brede Bræ
	mm.	mm.	mm.
Length from the point of the muzzle to the anal opening, measured along the under side of the animal	235	190	200
Length of the tail.........................	83	70	67
Length of the hind foot from the heel to the tip of the toe..........................	47	36	33

Musk-ox. *Ovibos moschatus* (Zimm.).

In comparison to the great multitude of traces, excrements and parts of skeletons which the expedition found almost everywhere on its excursions, as well on the continent as on the islands, even on the very smallest of these, the number of animals seen was comparatively small.

Most numerous the species was found in the high north, where the chartographic sledge expedition of Mylius-Erichsen and Koch killed about half a hundered animals. Also on the mountains at the head of Dove Bugt, most especially between Mørkefjord and Sælsøen, and even close by the border of the inland ice, some of the animals were strolling about, yet probably only in smaller parties, paying visits now and then to the low, richly grown country west, north and north-east of Hvalrosodden. The musk-ox was sought for in vain on Store Koldewey, in the country near the ship's harbour, at Stormkap and at Kap Marie Valdemar, though these places offer excellent opportunities for the animals which must have lived here formerly in great numbers, judging from the numerous traces and parts of skeletons left.

In the following I shall shortly relate partly my own, otherwise rather scant observations, partly the informations obtained through the notes of my fellow travellers.

During my first visit to the country near Hvalrosodden, August 1906, I found traces of the musk-ox everywhere, yet most numerously on the wide, fertile plains north and north-west of the headland. Even though most of the traces seemed rather old, I also came across several quite fresh ones; in a clayey, almost dried-up river bed I thus found fresh foot-prints of an adult animal and a smaller calf. Great numbers of craniums — mostly of old bulls — and other parts of skeletons were scattered about, partly on the plains, partly on the stony mountain ground between Rypefjeldet and Sælsøen.

After four days spent in vain search for musk-oxen in the above named country, on August 25th a hunting party succeeded in finding on the low, evenly sloping mountains north-east of Hvalrosodden, a group of 21 animals, among which were 3 calves and some not quite full-grown specimens. The animals were very shy, and when by means of the greatest caution the hunters had come within shooting distance and killed 4, the rest of the herd fled to the mountains towards the north, where at last the hunters lost sight of them. Among the killed animals were a calf of about four months, a grown-up cow with milk in the teats, besides two old

bulls. The adult animals were shedding their wool which was entangled in large tufts in the long overhairs. The stomachs were filled with grass.

On an excursion to the mountains between Mørkefjord and Sælsøen in the beginning of September 1906 JARNER, the geologist of the expedition, observed no less than four herds of musk-oxen. The observer finding himself each time at a disproportionately great distance from the animals, he was not able to state the size of the herd with certainty; he supposed however that they numbered only

Fig. 22. Skeleton parts of musk-oxen.

four — seven animals. The musk-oxen were seen on a table-land about eight hundred meter high, rather poor in vegetation, from which some isolated summits rose here and there to a height of about one hundered meter. On October 19th 1906 I saw on the flat coast country near Snenæs, east of Hvalrosodden, 4 musk-oxen, two old and a younger bull, besides an old cow, in a party. A thick carpet of newly fallen snow covered the ground everywhere, and probably for that reason I was not able to approach the animals more than at a distance of 600 meter. In a short gallop through the loose snow which was about 70 cm. deep, the animals hurried away to the mountains, making halt now and then for a few seconds and gazing down towards me.

When I again visited Snenæs twelve days later, the same four adult animals were grazing close by the beach. Though even this time they seemed inclined to make their escape, they were at last all shot. They were extremely magnificent, large animals in complete winter dress. The stomachs were filled with fine grass. The pungent, disagreeable taste and smell peculiar to the meat and skin of the males in August (the pairing time) was not found in these three bulls.

The expedition being in extreme want of fresh meat, in the spring 1907 several hunting parties were sent to the tract west and north of Hvalrosodden, in the hope of meeting with musk-oxen once more, but all in vain. The animals seemed to have withdrawn to the less accessible regions near the inland ice. I found traces of a musk-ox that had been walking alone on the snow at the foot of the mountain "Trekroner" on May 28th, but I did not see the animal.

On the little rocky island "Pladen" in Dove Bugt, I found in August 1907 several old traces and excrements of musk-oxen. Skulls, vertebral columns and other skeleton parts belonging to at least 10 animals were scattered over the island. On one of the craniums found, fragments of the hairy hide still remained.

On August 26th a probably very old, but not especially large bull suddenly appeared at the tent camp on Hvalrosodden and was shot. Evidently the animal had been walking far about, and judging from his drenched fur I concluded that he must have forced the rivers and smaller lakes which he had come across on his wanderings, this part of the country being especially rich in such. Probably the bull had been excluded from a herd which was staying farther away in the country towards the west, the traces of the killed animal leading distinctly in that direction. The meat of this bull had such a disagreeable pungent taste and smell that it was almost unfit to be used as food for human beings.

The stomach contained hardly anything but grass.

A singly walking old bull was killed in the beginning of July 1908 at Snenæs, about 8 kilometer from the coast. Judging from the fresh traces the animal must have been walking here the previous days. The mouth of the bull was filled with fresh *Salix* branches. Neither meat nor skin was encumbered with rank smell.

Records from the sledge expeditions to the north.

On April 29th 1907 Wegener and G. Thosthup saw in a relatively fertile and grassy country — lat. 80° 35′ n. — 4 musk-oxen in a party: two adult bulls, a cow and a heifer. The animals were killed with exception of one of the bulls. The stomachs were filled

with fine, withered grass. — On their journey to the south to lat. 80° 1/2′ n. WEGENER and THOSTRUP found along the beach numerous foot-prints and other signs of the presence of the musk-ox in this part of the country.

In Peary Land on Herlufsholms Strand — lat. 82° 50′ n. KOCH and BERTELSEN met with 4 old cows in a party, on May 7th 1907. Two of the cows were followed by very young calves, and when the animals were killed, it was proved that each of the other cows

Fig. 23. Young musk-ox calf.

contained a fully developed foetus of the size of a newborn calf. The stomachs of the cows were filled with short, withered grass.

At a distance of a few hundered meters from the shot cows, the travellers saw on the following day another herd of 11 animals: two old bulls, three cows leading their young calves, two heifers and a young bull. The animals were all killed. Even in this case the stomachs contained nothing but grass.

The length of the four newborn calves — measured from the muzzle to the anal opening — was 83, 85, 87 and 93 cm. On account of the extremely difficult travelling conditions, the partakers in the expedition must restrict themselves to take only the skin of one calf out of this interesting material. (This skin is to be found in the museum of Copenhagen.)

Koch and the Greenlander Gabrielsen having shot the last mentioned herd of musk-oxen with exception of a newborn calf, this calf followed the two men like a dog to the tent which was situated at a distance of about 8 kilometer from the hunting ground. Without being the least afraid of the ferocious sledge dogs which had just torn its little companions to pieces, the calf rubbed itself confidently against the legs of the men, displaying on the whole the greatest fearlessness and affection.

The locality on which the two herds of musk-oxen were found was richly grown with grass. From a low, fertile coast country an extensive mountain plateau rose about 15 kilometer from the sea.

On the southern side of Hydefjord — lat. 83°10′ n. — Koch and Bertelsen saw some days later on a 500 meter high mountain plateau several fresh traces of musk-oxen. Suddenly six sledge dogs appeared, hunting an old bull which tumbled down at length into a deep ravine, followed by its pursuers. The bull and five of the dogs were killed in the fall, while the sixth dog remained unhurt and returned to the sledges after the lapse of a few days. Before that time it had devoured a part of the musk-ox.

From a letter by Mylius-Erichsen, dated May 28th 1907, it appears that his sledge party at Danmarks Fjord — lat. 81° n. long. 29° w. — had shot 21 musk-oxen.

According to the diary left by Brønlund, the sledge party shot later on — in Mylius-Erichsens Land near the coast — 6 adult animals and 1 calf (June 16th), and a month later in the same place an adult animal walking alone.

So far the travellers to the north.

On a rather large island near Teufelkap Jarner found on May 25th 1907 fresh traces in the snow of three musk-oxen. Not far away the excrements of the animals were seen on snowless ground. The locality was rather fertile, especially rich in grass.

At the border of the inland ice, not far from Sælsøen, Lindhard found in April 1908 the skull of a very large musk-ox bull.

On the large nunatak north of Dronning Louises Land — 60 kilometer up in the inland ice — Koch came across traces of musk-oxen in many places, in May 1908. The vegetation was here relatively rich, according to the statement of the narrator mostly like that at Kap Bismarck (the ship's harbour).

In the bottom moraine at the border of the inland ice, according to Koch the *Glyceria angustata* was growing most luxuriantly. Magnificent tufts of this species of grass were to be found everywhere; often the grass had been gnawed to the very root by musk-oxen.

On the southern side of Hochstetters Forland — lat. 75° n. — Jarner found towards the end of April many fresh traces of musk-oxen on the snow. The animals themselves he did not see.

Bones of musk oxen were found near many of the old Eskimo dwelling-places examined by the expedition. Some of the skulls which were lying everywhere in the ground were highly decayed and covered with lichen. On these skulls the sheaths of the horns were quite devoured by time, and there is no doubt that they must have remained there for centuries.

Some of the skulls found in the ground have been brought home to the museum, among these a few specimens of the above described old type.

Reindeer. *Rangifer tarandus* L.

In those parts of the country which were visited by the expedition, the reindeer now seems to have disappeared completely.

However, innumerable testimonies of the rich occurrence of the species in former times were met with everywhere, yet not more to the north than on Holms Land — lat. 80° 24′ n. — where we found some horns of reindeer in old Eskimo dwellings.

Dropped horns and the excrements of the animal remained as well on the smallest islands as on the continent.

On the small rocky island "Pladen" in Dove Bugt I thus found no less than about fifty horns of reindeer, and the two little islands Maroussia and Renskæret, lying towards the sea, were strown with horns and heaps of excrements.

In many of the old Eskimo dwellings examined by us, prepared antlers and other remains of reindeer were found.

The antlers found on the ground seemed to be of very different date. Some were partly decayed and overgrown with lichen, while others were comparatively fresh. As a rule the horns were lying uncovered, yet we found not rarely horns partly or completely covered with mould.

In size and shape the horns varied extremely. Some of them had a round, almost cylindric main trunk, others a highly compressed one. The branches might be broad, sometimes shovel-shaped, small and round etc. (A large sortiment of reindeer horns found in the ground was brought home to the museum in Copenhagen.)

Only in exceptional cases fragments of the skeletons of the animals were found. These are quickly gnawed to pieces by foxes and wolves, moreover they would be much less qualified to resist the devastating influence of time than the horns. Also the foot-prints of the animals were everywhere obliterated. These facts seem to imply that the parts of the country concerned have not been inhabited by reindeer during the last decenniums, as the traces of the animals left on clayey ground no doubt will remain untouched for several years in arctic countries.

The hard dry dung of the animal is sure to be able to resist the influence of centuries, if it falls in places deprived of vegetation and not exposed to the inundation of melt water.

BIRDS

List of birds
observed in North-East Greenland.

1. *Fuligula marila.*
2. *Pagonetta glacialis.*
3. *Somateria mollissima.*
4. — *spectabilis.*
5. *Mergus serrator.*
6. *Anser torqvatus.*
7. — *leucopsis.*
8. *Lagopus mutus.*
9. *Colymbus septentrionalis.*
10. — *glacialis.*
11. *Fulmarus glacialis.*
12. *Ægialitis hiaticula.*
13. *Strepsilas interpres.*
14. *Tringa maritima.*
15. — *canutus.*
16. — *alpina.*
17. *Calidris arenaria.*
18. *Phalaropus fulicarius.*
19. *Larus leucopterus.*
20. *Larus glaucus.*
21. — *tridactylus.*
22. — *eburneus.*
23. — *sabini.*
24. *Sterna macrura.*
25. *Lestris longicauda.*
26. — *parasitica.*
27. — *pomatorhina.*
28. *Cepphus grylle.*
29. *Uria arra.*
30. *Mergulus alle.*
31. *Alca torda.*
32. *Falco gyrfalco.*
33. *Nyctea nivea.*
34. *Corvus corax.*
35. *Saxicola oenanthe.*
36. *Cannabina linaria.*
37. *Emberiza lapponica.*
38. — *nivalis.*

I. List of nesting birds.

A. Birds, nests of which were found.

1. *Pagonetta glacialis.*
2. *Somateria mollissima.*
3. — *spectabilis.*
4. *Lagopus mutus.*
5. *Colymbus septentrionalis.*
6. *Ægialitis hiaticula.*
7. *Strepsilas interpres.*
8. *Tringa alpina.*
9. *Calidris arenaria.*
10. *Phalaropus fulicarius.*
11. *Larus glaucus.*
12. — *eburneus.*
13. — *sabini.*
14. *Sterna macrura.*
15. *Lestris longicauda.*
16. *Cepphus grylle.*
17. *Falco gyrfalco.*
18. *Emberiza nivalis.*

B. List of birds certainly breeding but nests not found.

1. *Anser torqvatus.*
2. — *leucopsis.*
3. *Fulmarus glacialis.*
4. *Tringa canutus.*
5. *Larus tridactylus.*
6. *Nyctea nivea.*
7. *Corvus corax.*

II. List of birds occurring accidentally on migration probably nesting now and then.

1. *Mergus serrator.*
2. *Tringa maritima.*
3. *Larus leucopterus.*
4. *Uria arra.*
5. *Cannabina linaria.*
6. *Saxicola oenanthe.*

III. Accidental visitors.

1. *Fuligula marila.*
2. *Colymbus glacialis.*
3. *Alca torda.*
4. *Emberiza lapponica.*

IV. Birds restricted to the pack-ice and even there occurring accidentally.

1. *Lestris parasitica.*
2. — *pomatorhina.*
3. *Mergulus alle.*

Scaup Duck. *Fuligula marila* L.

Of this in Greenland very rarely occurring duck[1] I saw two specimens, male and female, at Stormkap June 21st 1907.

The Scaups stayed for a long while in a little clear lake with shallow water about one km. from the coast. (Bjergandesø, see the map.)

They always avoided the company of other ducks — the Long-tailed-Ducks and the King-Eiders — which were lying in the lake.

The Scaups proved very shy in contrast to these and it was not before July 2nd that I succeded in securing the male, whereupon the female finally disappeared.

The stomach of the male contained remnants of plants and small stones.

Judging from the sexual organs of the male, the ducks would not have nested that summer.

The skin of the male was brought home for the zoological museum in Copenhagen.

It belongs to the typical circumpolar form.

On the fresh bird the following measurements have been taken:

Total length	Wing	Bill	Tarsus
500 mm.	220 mm.	46 mm.	40 mm.

Iris: bright yellow. The legs dark lead-coloured.

Long-tailed-Duck. *Pagonetta glacialis* L.

Very common breeding bird in N.-E. Greenland.

Especially in the lakes at Danmarks Havn in the territory at Stormkap and the large river at Hvalrosodden this bird was

[1] According to H. Winge: "Grønlands Fugle" the Scaup is recorded only a few times on the west coast of Greenland. On the east coast it has never appeared before.

abundant. More sparsely I found them in the fresh waters far inland and at the heads of the firths. I also met with a few nesting birds on the smaller isles, lying near the field-ice as for instance Renskæret and Maroussia.

Most northerly it was seen at lat. 80° 23'. n; Koch here observed 2 Long-tailed-Ducks in the open water off Mallemukfjeldet (June 8th 1907. In the summers 1907 and 1908 this species arrived at Stormkap respectively June 15th and 11th.

The birds first arrived were almost all males.

The duration of the migration was about one week. Like the Divers and the King-Eiders — the company of which this bird liked to join — the Long-tailed-Ducks were obliged to fly far and wide to find their food. Open water was extremely sparse and even the smallest ponds of melted ice were therefore visited by the birds. As however the larger fresh waters gradually thawed, the birds resorted to these. The Long-tailed-Duck preferred small lakes with shallow water lying near the coast; but also in the mouths of larger rivers the birds used to stay, generally however only for shorter periods. At this season the birds were hardly ever to be seen in cracks made by the tide or in salt-water melting-ponds.

By the end of June I met with couples of Long-tailed-Ducks everywhere at the nesting-places. Before this time violent pairing-battles — or perhaps more correctly pairing-plays — were fought.

These were very interesting to observe: I often saw 2 to 3 Drakes chasing one Duck, and often they pursued her under the surface of the water. The peculiar far sounding voice of the birds was continually to be heard in the pairing season. The birds used to be very little shy at the nesting-places. On my arrival they would only swim to the middle of the pond even on quite small waters.

Though the pairing seemed to go on in quite the normal way in the summer of 1907, the ducks — like other sea-birds — did not nest this summer; I assured myself of the fact by diligently visiting the nesting-places — wellknown from the preceding summer. I found only one brood with two half-grown young ones in the large river by Hvalrosodden. (August 22nd.)

The Duck, which accompanied her young ones, had lost her primaries by moult. The number of old birds corresponded to what I had seen on the same localities in August 1906.

In 1908 the breeding conditions were normal.

In the beginning of July several females had begun to nest. A fully developed egg was taken out of a bird killed June 24th. Some Ducks would nest much later in the season; thus I found still many

downy young by the end of August 1906. In June I found some old birds in lakes in a distance of some 5 to 6 kilometer from the coast, but there was no indication of their breeding here and I suppose, that the nesting-places are always chosen at such places, from which the nestlings have an easy access to the salt water, to which they — according to my experience — are at once directed.

I found several old nests, which all were built on grassy banks of lakes, lying near the coast. When the Ducks had begun their breeding, the Drakes would still stay near the nest for a while. Not before the moulting season would they gather in flocks by the mouths of rivers and small bays; here they are not so exposed to hostile persecutions during the time in which they are unable to use their wings for flight.

Soon after our arrival to the Danmarks Havn (August 17th 1906) I had a very good chance to study the behaviour of the Long-tailed-Ducks. In the openings of the little bay covered with new ice larger flocks of old males were lying; the birds had quite lost their primaries.

In a quite small opening near the shore some 60 birds were lying very close to each other. Only one bird was able to fly; the others endeavoured by diving to escape the pursuit of the boat, which was forced through the ice. Some of these birds were killed and examined. A female with 6 small young ones was swimming at the mouth of a river not far from this place; on my arrival they made themselves invisible under the surface, exhibiting a great dexterity in these evolutions. I observed the small downy creatures rushing round under the thin transparent ice soon after one by one returning to the open water. There they only lifted their heads over the surface and as they constantly kept themselves close to the weathered pieces of ice in drift, the movements of which they followed, they were extremely well hidden.

They seemed by no means inconvenienced by the stay in the ice-cold water.

The next day the ice had quite disappeared, driven away by a strong land-breeze.

During my stay at Hvalrosodden in the last part of August 1906 I every day observed many broods of young ones at the shore and in Lakseelven. The majority were still downy; they were often hunted by Ravens and Gulls (*Larus glaucus*) especially when they had retired for resting purpose to the shore or banks of the river.

Early one morning I saw an old Gull snatching an almost full-grown Long-tailed-Duck, having first in vain made some violent attacks upon the flock.

The number of chicks in a brood varied from 3 to 7.

In the river some 50 old males were continually to be seen; at the end of August some of them still had their primaries so little developed, that they were very far from being able to fly. At regular intervals the birds swam to the mouth of the river and a little way out in the bay; from here they returned after some hours and rushed in a close crowd up the river, to the beaches of which they would always retire for the night. In August 1907 I visited "Hvalrosodden" again and found just as many males in moult as I did the preceding year.

Some flocks of younger non-moulting and non-breeding birds had settled off the mouth of the river and in the bay. These birds would often fly far and wide, sometimes as far as the shores of Dove Bugt. I also met with them up the river sometimes in company with the old males. The last Long-tailed-Duck was seen September 18th.

In the beginning of summer this species will almost exclusively stay in the fresh waters and then its food is of very different kind. In the stomachs of birds killed at this season I sometimes found remnants of plants. The food however, seemed essentially to consist of insects and larvæ; one stomach contained exclusively larvæ of gnats. In the stomachs of two downy young I found only small stones.

When feeding in salt water they mainly eat mussels and small crustaceans; this has been proved by numerous examinations of stomachs. For the zoological museum in Copenhagen were collected the skins of 4 old birds. Further 3 old birds and 4 downy young in spirit and 1 egg.

The following measurements have been taken:

Sex	Age	Date	Locality	Wing from the wrist to the tip mm.	Bill from the edge to the feathers to the tip mm.	Tarsus mm.	
♂	ad.	18/6 07	The ships-harbour	218	27	39	Full summer plumage.
♂	-	8/8 07	Lakseelven		27	36	The primaries lost by moult.
♂	-	12/6 07	Stormkap	214	28	35	Feathers of the winter plumage emerging.
♀	-	25/7 07	—	198	25	34	
♂	-	23/8 06	Lakseelven	196	27	34	In spirit.
♀	-	23/8 06	—		25	35	In spirit. The primaries lost by moult.
♂	-	23/8 06	—		28	35	In spirit. The primaries lost by moult.

Egg.

Date	Locality	Length	Breadth	
24/6 08	Renskæret	55 mm.	40 mm.	Taken out from a bird.

Eider. *Somateria mollissima* L.

Though the Eider occurred not rarely in the tracts, which were explored by the expedition, it was seen only in relatively small numbers.

I found the Eider most numerous at Maroussia, Renskæret and other small isles and skerries lying near the field-ice. On the two isles named were nesting some 20 to 30 couples.

During the navigation through the pack-ice the Eider was observed but once; this was just off Koldewey Islands August 14th 1906; 6 old females were lying here, and one of them secured.

The north-going sledge-party did not record this species.

In the summer 1907 the Eiders appeared at their nesting-places on the before mentioned islands June 10th, but like the other sea-birds, they did not nest this summer.

In 1908 the first couple of Eiders was seen June 17th.

The common Eider always stayed in salt water — in cracks or openings in the ice — especially near isles and skerries and only exceptionally near the head of the firths — in marked contrast to the King-Eider, which in the beginning of summer always would settle in the fresh waters on the mainland. The first eggs were found in the beginning of July. The nests were built in the most different localities, as well on shelves on naked rocks as in grassy or stony lowlands. I found some nests from the preceding years on the edges of the old Eskimo burial places on Maroussia and Renskæret; the vegetation here was luxuriant. The number of eggs in a clutch was almost always 4. The males would generally stay near the nests till the end of July.

Twice I had the opportunity of observing, that some chicks are so late in growth, that they become caught in the new ice. In a little opening in the ice between Baadskæret and the coast I observed October 7th 1906 a female with her 4 young ones which had hardly yet attempted to fly though their primaries were fully developed. With a rifle shot I killed one of them, but the thin ice prevented my getting it. The old Duck startled by the shot, flew anxiously around the opening for some moments accompanied by one young one, which soon after however took to the water again. When I visited the place next morning the severe cold of the night had caused the opening to narrow very much and the Duck had disappeared. The young ones were swimming incessantly to and fro in order to prevent the water from freezing. They took no heed of a Polar Fox, which tripped around the opening and took great interest in the birds. The feathers, which were lying around,

proved, that the fox had already eaten the shot youngster. By means of a shot I scared away the fox for a while; he disappeared amongst the rocks on Baadskæret, but returned after a quarter of an hour and was very active against the Eiders. In the night the temperature sank to — 15° and next morning when I visited the Eiders for the third time, they were swimming in an opening, which was now hardly 2 □ m. in extent. The fox still kept guard on the edge of the ice. Having examined the strength of the ice, I secured one of the Eiders, the skin of which is brought home, and I succeeded in making the others take to their wings by throwing stones into the opening. With rather rapid but tremulous and low flight they made for the field-ice, where they disappeared. Open water was not to be seen now.

September 15th 1907 I observed in an opening in the ice in the Stormbugt a flock of Eiders, which numbered at least some 50 birds. They were all in dark plumage and I think they were all *S. mollissima.* I judged them to be young birds hatched farther north, migrating southwards.

By my last visit to Renskæret July 22nd 1908 13 Eiders — 8 Drakes and 5 Ducks — were lying between the icebergs close to the shore. One of the males was pied, the others in full nuptial plumage. I also observed some breeding females on this island.

In the stomachs of the Eiders I principally found remnants of shells.

For the zoological museum in Copenhagen were collected the skins of 5 Eiders and 4 eggs.

The following measurements have been taken:

Sex	Age	Date	Locality	Wing mm.	Bill[1] mm.	Tarsus mm.	
♂	ad.	15/7 07	Maroussia	268	38	51	
♂	-	3/7 07	Stormbugt	282	38	53	
♀	-	15/7 07	Maroussia	288	38	51	Total length of the newly killed bird 630 mm.
♀	-	14/8 06	Koldewey-coast	269	37	49	Total length 620 mm.
♀	jun.	10/10 06	Baadskæret	242	31	46	Total length 570 mm.

Eggs.

	Eggs	Length mm.	Breadth mm.
July 21th 1908. Maroussia. Highly incubated.	1	75	48
	2	72	50
	3	68·5	50
	4	67	48

[1] The measurements have been taken from the hindmost edge of the nostril to the tip of the bill. This different mode of measuring has been undertaken as the length of the base is very variable.

King-Eider. *Somateria spectabilis* L.

Rather common and nesting at least quite as frequently as *S. mollissima*. In the fresh waters at the ship's-harbour, Stormkap, Snenæs and a part of Hvalrosodden I met with several couples of nesting King-Eiders.

The majority of my observations regarding this species are therefore taken at these places.

The King-Eider became decidedly more common in higher latitudes. Koch and Bertelsen saw at Mallemukfjeldet June 9th and 10th 1907 a great many of them. The birds were lying in flocks on the open water near the coast and on the edge of the ice. The males were all in full nuptial plumage. Many individuals of both sexes were shot and eaten. From here no *S. mollissima* was recorded.

During the navigation through the pack-ice I observed August 14th 1906 in lat. 77° n. an old female, which came flying, and took the water near the ship and tried for a while to follow it swimming.

On the arrival of the expedition at the ships-harbour on August 17th several females, accompanied by their still downy young ones, were lying in the small openings in the ice.

Three days later I met with 5 broods of ducklings at the mouth of Stormelven; one of these broods was scarcely one week old. These broods all contained 5 ducklings — in one case 6 were seen.

The old birds behaved very anxiously when I approached and swam grunting around quite near me and the coast, while the young ones with a surprising rapidity moved outwards swimming and diving till they at last disappeared far out in the bay.

Not far from the mouth of the river I found a pair of nests on the slopes of the low rocks by the coast. The fresh down and egg-shells proved, that they had lately been inhabited.

Dr. Lindhard observed August 16th by Kap Marie Valdemar a pale coloured female accompanied by a male in normal nuptial plumage.

In 1906 the last bird was seen September 8th.

The King-Eider appeared the next summer on Stormkap June 10th. The same day a few couples were seen in the lakes at the ship's-harbour.

All the King-Eiders appeared in couples, though they no more than other swimmers nested that summer. Though they often gathered in small flocks, there were always just as many females as males. The King-Eiders appeared in even the smallest ponds of melted snow and their surprising fearlessness made it possible for me to observe them at quite short distance.

During their excursions in the field, the always flew very low and sometimes uttered a slight growling or grunting sound.

The King-Eider, which at this season always stayed in the fresh waters on the mainland, on which it undoubtedly exclusively nests, hereby forms a contrast to *S. mollissima*, which almost always takes to the cracks or openings in the sea-ice. I never saw the King-Eiders on islands or near these.

The males disappeared at the end of June after which the females gathered in small flocks.

Every day they used to fly from the lakes and ponds inland down to the bay and especially to the mouth of Stormelven, in which they would lie and dive for food. They used to lie for hours on the grass-clad beaches of the lake in order to rest or to sleep with their heads hidden under their wings.

At the end of July the last females left the lakes at Stormkap.

The King-Eider arrived in the summer 1908 on June 16th, a few days later than the preceding summer.

I counted some 20 pairs of nesting birds, which exactly corresponded to, what I observed on the same territory in 1907. In the beginning of July the majority of the females were occupied in breeding, and the males disappeared. A few barren females could be seen till the last days of July.

I did not succeed in finding nests with eggs but all the old nests I found at Stormkap proved, that this bird nests singly. The nests were placed on the lower slopes with luxuriant vegetation or on small hills in the lowland with large stones surrounded by grass.

None of the observed nests were far from the bay (as a maximum one kilometer). I think, that the young ones soon after their emergence were directed to this.

The down from the nests was very dark coloured, nearly black, and by this they may be distinguished from that of the common Eider.

I secured some breeding females whose breasts and bellies were nearly naked.

The females would in the breeding season sometimes leave the nest for a short while and fly to the nearest pond for the purpose of bathing and seeking food. Like many other birds the King-Eider is irritable and quarrelsome at this period. One evening I observed a female, which had just left her nest. She flew quickly straight towards me and so low, that she seemed to touch the earth with the tips of her wings. I was standing on the beach of a pond with shallow water. Uttering an angry grunting she circled around and quite near to me and then flew to the pond. Having quenched her

thirst and by a pair of quick bounds under the surface put her feathers in order, she swam straight towards me all the while uttering a peculiar growling and hissing; the feathers on her head were erected, and she seemed to be very much displeased at my presence; now and then she cackled in the shallow water like a domestic duck again to show her displeasure.

I secured the King-Eider in order to assure myself that she was a breeding bird and found her to be very thin and nearly naked on her belly. In the season in which the King-Eider lives in fresh water its food consists principally of plants. In the stomachs, which I examined, I found however many remnants of insects, especially larvæ of gnats. In the stomachs of downy young ones I found indeterminable remnants of crustaceans, plants and small stones.

I found no difference worth mentioning in the exterior of the males except in the V formed mark on the throast, which varied a good deal in extent and intensity.

The females on the contrary vary a good deal. Some birds — very old ones I think — were very pale, the others were rather dark.

A female killed (pale in colour) had a well developed prominence on the forehead; in other females I found a fainter indication of such.

For the zoological museum in Copenhagen were collected the skins of 4 old birds and 3 downy young in spirit.

The following measurements have been taken:

Sex	Age	Date	Locality	Wing mm.	Bill[1] mm.	Tarsus mm.	
♂	ad.	24/6 07	Stormkap	269	32	48	
♂	-	10/6 07	Lake at the ship's harbour	263	32	37	Total length 600 mm. measured on the fresh bird.
♀	-	24/6 07	Stormkap	257	31	46	
♀	-	18/8 06	—	256	31	46	Total length 560 mm. measured on the fresh bird.

Red-breasted Merganser. *Mergus serrator* L.

But once I met with this species.

On my last visit to Renskæret in the night of July 21st 1908 an old female passed me trice, while I was standing on the

[1] From the hind part of the nostril to the tip of the bill. This different mode of measuring has been chosen because the prominence varies very much in length and extent.

west coast of the island. The bird was flying quite low and took the water some 300 meters from the shore then rapidly swimming towards the coast, where I lost sight of her in the swarm of Terns.

Judging from her behaviour she must have had her nest on the island; but unfortunately I had no time to look for it, as I had to hurry back to the ship, which soon after started on its voyage homewards.

Brent Goose. *Anser torqvatus* Frisch *typicus.*

This species appeared but exceptionally on its northward migration in spring.

The geologist of the expedition met with a flock of 7 Brent Geese June 8th 1907 on a sledge-voyage on Koldewey-Island. The Geese wandered along the shore in a foggy snow-storm and took the water near the eastern coast of the island. Here a male was shot while the other birds flew out over the sea-ice and landed on the edge of a pond formed by melting snow. The same 6 Geese appeared again the following days; though very shy they followed the sledge-party northwards. The Geese often alighted on the shore or on the marshy stretches, which at certain places extend to the very shore.

In the beginning of June 1908 I saw a few small flocks of Brents on the beaches of the fresh water lakes near the ships-harbour. The Geese as a rule would walk about picking off the new short sprouts of grass not very far from the water.

They were very vigilant and shy.

Regarding the occurrence of this species farther North I have received the following notes from the north-going sledge-party (Koch, Bertelsen and Tobias Gabrielsen).

June 4th 1907. Lat. 81° 12′ n. A flock of 13 Brents flying seawards from land. Plenty of water on the ice. Distance from the nearest open water 1/2 mile (Danish).

June 6th 1907. Lat. 80° 57′ n. 24 Brents by the edge of the ice.

June 8th 1907. Lat. 80° 23′ n. 5 flocks of Geese (each containing some 25 individuals) were noticed along the shore and near the open water.

June 9th 1907. Lat. 80° 20′—80° 10′ n. At least 100 Geese were lying at the ice-foot and in the open water. Especially in the small bays Geese and other sea-birds were numerous.

June 12th 1907. Lat. 79° 40′ n. 17 Brents came flying and settled inland.

June 13th 1907. Lat. 79° n. A flock was seen.

Mylius-Erichsen's sledge-party has, according to Brønlund's posthumous diary, observed and secured some Brents in Mylius-Erichsens Land near the coast. The diary says: June 24th 1907. To day many Brents migrated southwards; 9 were secured.

It can scarcely be doubted that the Brents breed in the northern part of East-Greenland; but I did not succeed in getting certain information regarding this matter.

For the zoological museum in Copenhagen was prepared the skin of the male, which was shot June 8th 1907 on Koldewey-Island, and upon it the following measures have been taken:

Wing	Bill	Tarsus
324 mm.	33·5 mm.	60 mm.

Barnacle Goose. *Anser leucopsis* Bechst.

Only in one very restricted tract this bird was found. In the migration period the Barnacles were now and then seen elsewhere, but never far from the beforenamed place.

The north-going party of the expedition did not record this species.

August 1906 I found feathers and droppings of Barnacles on many places North and East of Lakseelven and Hvalrosodden; this landscape was full of small lakes, ponds and small rivers. Here 7 and 2 Geese were observed respectively August 25th and 27th.

May 23rd 1907 I found by the grass clad beaches of a larger lake, Gaasesøen, in the country a little farther West — near the rocks "Trekroner" — numerous traces of Barnacles from the preceeding summer.

The fresh waters were still fully covered by ice, and the earth was nearly completely hidden under heavy snow-masses. I was therefore surprised as I at midnight saw a Barnacle migrating from the South and flying cackling to the snow-covered fields some two kilometer North of the lake.

June 11th I observed and secured a solitary old male at a little and but partly open fresh-water-pond lying in the gravel-bank-district on Stormkap.

This Goose proved so confiding that it remained quite undistur-

bed on the beach of the lake although I failed in my first shot. In its stomach I found only remnants of plants especially withered grass.

August 7th I saw at the mouth of Lakseelven 15 Barnacles moving on the banks and picking up the short grass. They were very shy. Many pale and abraded feathers, which were left, proved that the Geese were moulting.

August 15th I met with two Barnacles by the steep western banks of Gaasesøen; at my arrival they were walking on the low rocks facing the lake, which were covered with luxuriant alpine willows and other vegetation. The Geese were moulting, and hardly in possession of full power of flight; they therefore hurriedly approached the lake, where they were shot. They proved to be old birds male and female. The stomachs and œsophagus of the birds were filled with twigs, leaves and catkins of alpine willow, with seeds of different plants and also grass.

About the same time a larger flock of Barnacles counting some 50 birds was seen in the marshes North of the ship's-harbour; but they soon left this place as they were chased and scared by the dogs from the ship.

June 8th and 9th 1908 I got my first opportunity to study the Barnacles in their real nesting-territory. Up to this time the Geese had led a comfortable and by me unsuspected existence in a lonely marsh- and moor-territory far up country — 10 to 15 kilometer from the nearest salt water — East of Sælsøen imposing by its extent and grandness of scenery. This territory, the farthest extent of which is in a northerly direction, comprises an area of some 20 □ kilometer; on the North it is bordered by a mountain-range, the lower slopes of which are covered by a vegetation more luxuriant than I saw in any other place in N.-E. Greenland.

To East and North the marshes lose themselves in barren stony plains sprinkled with sandy spots and a few deep lying fresh-water basins bare of all vegetation. To the South the steep and barren mountain of Trekroner rises to a height of 360 meter in small terraced projections.

In the marsh and moor itself the vegetation was extremely luxuriant; as well the alpine willow as other plants reached here a relatively gigantic size. All over the snow had melted, though it was early in the season, and the place offered an increased allurement to the swimmers and waders by the countless ponds of melting snow.

The influence of the powerfull sun-light on the dark turfy soil surely accounts for the unusually early melting of the snow in this place.

At my arrival the Barnacles were standing in couples or in small flocks in the ponds or they were grazing near these; some were high up the mountain-slopes.

Almost all the Geese used to leave the marsh every day at certain times and disappeared southwards towards the high middle part of Trekroner.

I set out in this direction, thinking that a larger lake was lying near the mountain, and that the Geese retired to this after their meal. I really found a pair of larger fresh water basins and saw

Fig. 1. Nesting locality of the Barnacles.

in these a few Geese, which being frightened flew farther towards the mountains. Having come within a distance of one kilometer from Trekroner I solved the riddle. The Barnacles were swarming to and fro along the gigantic mountain wall like bees at their hive, and I heard a continuous humming, sounding like a distant talk.

I took a seat at the foot of the mountain and observed the behaviour of the Geese for some hours. Using my field glass I could without difficulty notice even the smallest details.

While some of the Geese would constantly fly along the rocky wall and sometimes mounted so heigh in the air, that they disappeared on the other side of the rocks, the majority of the birds were sitting in couples upon the shelves of the rocky wall some of

which seemed too narrow to give room for the two birds — much less for a nest. It was only on the steep and absolutely naked middle part of the mountain wall that the geese had their quarters and in no place lower than some 200 meter from the base of the cliff. As the wall was quite inaccessible, I had to content myself by firing some rifle-balls against it in order to frighten the birds and thus form an idea of the size of the colony. The birds which were "at home" then numbered some 150 individuals. As far as I could judge breeding had not yet commenced.

I feel sure, that some of the Geese resorted to the mountain without intending to breed. A pair of females, which I later on secured in the marsh had but undeveloped eggs in their ovaries.

In the mountain the Geese were not very shy and paid no attention to my shots; the great height at which the birds always stayed evidently made them confident.

In the marsh, however, they were very vary and almost always had sentinels posted, while they were seeking food.

The males were notably larger and more intensely coloured than the females.

On the rocky wall in the middle of the Goose-colony a couple of Falcons had their nest. (Regarding this and the behaviour of the Falcons to the Barnacles see: Gyrfalcon.)

As the place was lying so far out of my way and as the time for the return of the expedition was rapidly approaching I unfortunately got no other opportunity to observe the Barnacle-colony.

For the zoological museum in Copenhagen were collected the skins of 3 old birds, upon which the following measurements have been taken:

Sex	Age	Date	Locality	Wing mm.	Bill mm.	Tarsus mm.	
♂	ad.	11/6 07	Stormkap	410	33	77	Total length of the fresh bird 710 mm.
♂	-	15/8 07	Gaasesøen	In moult	32	77	
♀	-	15/8 07	—	390	32	71	

Ptarmigan. *Lagopus mutus* Mont.

Ptarmigans were observed almost everywhere in the tracts explored by the expedition, but nowhere in great numbers.

They occurred most frequently — also within the breeding-season — on islands, even on the smallest, and as well on those

lying farthest out to sea as for instance Lille Koldewey, Maroussia, the outer skerries, Ile de France as on those farthest up the firths as Nordre Orienteringsø and all the small islands in Dove Bugt.

In April 1908 many foot-prints of Ptarmigans were seen in Dronning Louises Land 60 kilometer up the inlandice.

Koch and Bertelsen found May 18th 1907 fresh foot-prints of Ptarmigans in the snow on a very extensive table-land lying on lat. 83° 12′ n. 500 meters over the level of the sea.

According to Brønlund's posthumous diary the Ptarmigan must have occurred rather commonly in Mylius-Erichsens Land, especially along the western coast of Danmarks Fjord. Thus the travelling party has secured 13 Ptarmigans on one day viz. August 26th 1907.

In the absolutely dark season Ptarmigans or foot-prints of them were nowhere found in spite of numerous researches on different places, and there can be no doubt, that this species for some three months leaves this part of North-East Greenland.

It may be supposed, that the birds only migrate to somewhat more southerly lying parts of East Greenland[1] as they already begin to return in the beginning of February, when the sun has not yet appeared. (In 1907 the first Ptarmigan was seen at the ship's harbour February 4th and the next year 4 days later.)

The migration lasted through February, March and the larger part of April, and the number of Ptarmigans within a certain place might differ a good deal in this time.

In the coldest season (February and March) the Ptarmigans wandered around in small flocks numbering 2 to 5 birds, rarely more, but not unfrequently singly; the stayed on the plains generally near the shore seeking their food on spots swept clean by storms.

Their principal food consisted of buds and short bits of stalks of *Salix arctica.* According to Dr. Lindhard's analyses stomachs of Ptarmigans shot at this season also contained leaves of *Dryas octopetala* and crowns of leaves of *Saxifraga oppositifolia.*

In fine weather these hardy birds did not seem inconvenienced by the temperature frequently as low as some 40° below zero. But it was hard to the Ptarmigans to support their lives during severe snow-storms, and when the earth was covered by thick evenly lying crusted snow.

At sunset they flew to the rocks and remained there over night.

[1] According to H. Winge: "Grønlands Fugle" wintering Ptarmigans are seen on Shannon Ø even in great numbers.

In the heavy snowmasses on the leeside of the rock they digged holes some 20 centimeter deep, just large enough for the body of the birds, and here they spent their nights apparently without ever altering position judging from the manner, in which the excrements were deposited. When several Ptarmigans had spent a night in company, their holes were always placed within a rather narrow circumference sometimes nearer and sometimes at a longer distance, but never quite close to each other. The Ptarmigans would also often spend their nights in narrow ravines in the rocks filled up with snow.

Sometimes I found my old foot-prints taken possession of by the Ptarmigans as night-quarters. They were by night not seldom frightened out of their holes by Polar Foxes and Ermines, which could be easily seen on newfallen snow. I found, however, in no case signs, that Ptarmigans were caught in this way.

The Ptarmigans proved incredibly fearless or perhaps more correctly indolent towards human beings. When the birds had eaten heavily, they used to sit or lie immovable on the snow at the place, where they last had found their food, and then they were extremely difficult to distinguish from the surroundings. Under such circumstances, they could often hardly be driven from their lair in the snow, but could be shot down one by one. When starteled from their resting-place, they would sometimes only run some paces away to scrape a new hole by rapid movements of their feet.

When the birds walked around on a spot bare of snow seeking food, they did not behave so sluggishly, but still they could be approached within some 3 to 4 metres or even nearer. The females seemed least patient towards human approach.

When a female Ptarmigan was going to fly up, she would raise the feathers on the back of her head to a pointed crest and lay the tips of her wings on the upper rump uttering a suffocated clucking, that could best be compared with the call of *Fringilla montifringilla*; at the same time she would execute some courtseying movements with her head and the forepart of her body.

Behaviour like this may, however, also express her especial delight.

Just after a heavy snow-storm, that covered all the earth evenly with snow, the Ptarmigans would prove extremely shy. For a few moments at a time they would settle on summits of rocks or stones, that reach over the snow, and then by a rapid soundless flight disappear around corners of rocks through deep ravines or out over extensive plains. When the Ptarmigans after some hours had found places with food, they would again become tranquil.

Crusted snow was penetrated in that way, that the birds first by their bill picked through the crust and then by means of their feet proceeded to the desired plants.

Plants, which were covered by ice or hoar frost, were carefully cleaned before they were eaten.

When by the end of March the weather was fine a few males would already begin to cackle; but the Ptarmigans did not appear in couples before a month later; in this time the males had obtained their real pairing exterior: strongly coloured and developed comb-like crests.

The cackling of the male may be expressed as orrr.'

March 13th 1908 I met on the eastern slope of Harefjeldet with 5 female Ptarmigans. While 4 of them were looking for food, the 5th was sitting on the summit of a solitary lying large stone from which she twice just like a cock rose cackling in the air. This hen behaved in every way like a cock in pairing passion. She went down to the stone with her tail-feathers very much spread, and her comb erected and then flew down to the earth to court her friends keeping the wings low and her crest erected. I shot the 3 Ptarmigans; the anatomical determination of their sex was not difficult; the curious cock-imitatrix contained eggs as large as partridge-shot. During this observation the weather was fine.

The majority of the Ptarmigans left the shore and went farther up the country at the beginning of the breeding season. As indicated before some Ptarmigans would nest on islands, where they were not so exposed to attacks from Polar Foxes and Ermines during summer.

The pairing usually took place early in the morning; at this time the birds were most lively. The laying began in the first half of June. (A full-grown egg in shell is taken out of a bird June 11th.) According to my observations the cock stays near the nest also after the hen has commenced breeding.

August 16th I met with a hatch of 9 chicks on the little rocky island "Pladen" in Dove Bugt; they were somewhat larger than Starlings.

By the end of August and in the beginning of September several times flocks were observed counting some 20 birds, nearly full-grown young and old Ptarmigans mixed.

In stomachs of shot young ones I found remnants of plants as well as of insects. The old birds in summer also partly feed on insects.

The old Ptarmigans appeared again on the lower plains near the coast at the time for their departure in October. As on their migration in spring, they appeared singly or in small flocks.

The young Ptarmigans are persecuted by Foxes and Ermines as well as by Ravens, Falcons and Snowy Owls.

As to the old birds, Falcons are certainly the most dangerous enemies.

Judging from the leavings at the Falcons nest it is, however, only few Ptarmigans, that in this way are destroyed.

The moult of the Ptarmigans of N.-E. Greenland.

In the countries explored by the expedition the laying of the eggs — as said before — generally takes place in the first half of June.

As in other countries the chicks will in a relatively early age get their flight-feathers, which make them able to fly.

In the first plumage the chicks have undulating lines on the dorsal feathers which have black ground. The cross-bands on the black ground, which give the feathers their undulated exterior, are of a white-greyish-yellow colour.

The feathers of the shoulders and the middle of the back are principally black with but a few pale tips of the above named colour.

The feathers on the breast and fore-neck are white-greyish-yellow with dark-grey cross-bands and quite similar to those of the sides of the body. The belly and under tail coverts are greyish-white. The primaries are pale greyish with lighter markings.

The fledgelings will from this plumage pass over into the first dark plumage of the grown bird. (3 skins in this stage are at hand: 2 females and 1 male shot on Rypefjeldet August 29th 1906.)

These young birds have lost almost all their grey primaries, which are now replaced by the white ones of the old birds.

The tail now consists of well developed feathers which are of a China-ink colour with narrow white bands on their tips. The feathers of the abdomen, the under tail coverts and the feet are white.

The feathers of the back, the fore-neck and the head partly belong to the first plumage of the young bird having, as already mentioned, broad undulating lines on a black ground, and partly to the first plumage of the grown up bird showing fine undulating lines; the colour is greyish-yellow-brown with thin black bands in zig-zag lines.

From this plumage the young Ptarmigan passes over into its first complete winter-plumage, which is white with exception of the lores, the tail and the shafts of the primaries, which are black.

All the males in winter plumage have black lores and the black colour is always continued a little behind the eye of the bird. The majority of the females also have black lores, but in many birds

— certainly young — only some dark spots are to be found near the base of the bill and the dark colour is seldom continued behind the eye. Only exceptionally I secured female Ptarmigans without any trace of black in the lores.

It is already indicated, that almost all Ptarmigans left the country during October and reappeared in the first days of February. Then all the Ptarmigans were white with exception of the lores, tail-feathers and the shafts of their primaries. A few individuals (of both sexes) had a single feather with undulating lines from the last autumnal plumage on their neck, lower throat, wing or rump. The white plumage is retained in March and April.

On the hens a great many black cross-streaked feathers emerge on a sulphur coloured ground. (3 skins from this stage are at hand, one secured May 25th and two May 26th.) Now the white plumage is gradually replaced by cross-banded feathers, and the female Ptar-

Fig. 2. Heads of female Ptarmigans in winter plumage, showing black feathers on lore.

migans appear at the beginning of the breeding-season — especially on the back — in the darker-coloured summer-plumage.

Characteristic of this plumage is the dark colour of the dorsal feathers with straw-coloured bands. The centres of the dorsal feathers are black, and the cross-bands do not meet at the shaft. On the contrary the feathers of the fore-breast, neck and sides of the body are strongly yellow with black bands running across the feathers. A female, which was shot June 11th and contained a ripe egg, has her back coloured as described, with the only difference that many of the yellow borders of the feathers are so faded, that they must be called greyish-white. All the white feathers of the belly are not yet lost, and the belly of some individuals in this plumage may perhaps remain white.

August 15th 1907 a hen going with a brood of chicks was shot on the rocky island Pladen; her dorsal feathers were now so faded, that the dark part of the feathers are in preponderance and the yellow colour of the pale parts has almost disappeared making the bird look dark-greyish. The entire under side of this Ptarmigan is cross-streaked.

From this summer-plumage the hen passes into the autumn-plumage. Two birds secured respectively August 15th and 16th are in almost pure autumn-plumage; feathers from the summer-plumage are, however, still to be found scattered over the back, the sides of the body and elsewhere on the bird. One hen secured some days before still more approaches the pure autumn-plumage, which consists of brownish-grey feathers with fine undulating markings; only the belly and the wings are white. These autumnal feathers may by described as follows: On a brownish-grey ground numerous black spots are scattered, which without forming lines still produce a kind of zig-zag markings across the feathers, the tips of which have a pale cross-band. The borders of the feathers are greyish-black.

No hen in absolutely pure autumn-plumage was observed.

The hen will, before she leaves the country, gradually change her fine autumn-plumage for her white winter-plumage.

The cock within the pairing-season generally appears in full winter-plumage; before the hen has begun her breeding, however, cross-banded feathers of the summer-plumage emerge on the crown of the head. Gradually as the moult from the white to the summer-plumage proceeds, the male resorts to the rocks in which he lives very retired; therefore it is extremely difficult to follow this moult. I succeded only in securing one cock in pure summer-plumage; this is figured Pl. III. The belly and wings are white, the tail black with a well marked white band on the tip. The dorsal feathers are dark with whitish-grey cross-bands; the undulating lines hereby formed are however finer than in hens in corresponding plumage.

Very likely, this plumage of the cock scarcely ever becomes pure, because the finely banded feathers of the autumn plumage already appear on several parts of the body before it is finished. The short time in which the cock has to finish his moults in these northern latitudes accounts for this. It must be taken into consideration, that he within the time from the end of June till the end of September must pass from the white winter-plumage to summer-plumage, from summer-plumage to autumn-plumage and finally from this to the winter-plumage again; thus it is no wonder, that the cock during summer almost always appears in a mingled plumage.

I consider the autumn-plumage to be very handsome: belly, wings and tail like those of the summer-plumage, while the other feathers of the body have a beautiful brownish-grey colour and are minutely dotted as described in the hen. 4 birds in this plumage are at hand. Their ground colour varies from pale brownish-grey to a "warmer" colour.

On the limit between the white feathers of the belly and the

brown undulated of the sides of the body may — on almost all Ptarmigans of both sexes — be seen some feathers, which are partly white and partly undulated; it is perhaps such feathers, that have given room for the supposition, that a change of colour without moult takes place from autumn to winter-plumage. The collected skins do not confirm such a supposition, because pure white feathers may be found everywhere.

From the autumn-plumage the cock goes to the white plumage again.

I do not dare to say anything with certainty regarding the change of the claws of the Ptarmigans, as I on this point have found the greatest dissimilarities in individuals of both sexes in every season and of different ages.

For the zoological museum in Copenhagen were collected the skins of 14 full-grown Ptarmigans and three almost full-grown young ones and one smaller young in spirit; further 1 egg.

The following measurements have been taken:

Sex	Age	Date	Locality	Wing mm.	
♂	ad.	14/2 07	Koldewey Island	215	Measured on the fresh bird.
♂	-	15/2 07	The ship's-harbour	208	Measured on the skin.
♂	-	6/5 07	—	187	—
♂	-	9/5 07	Maroussia	200	—
♂	-	11/6 07	Stormkap	211	—
♂	-	20/6 08	Pladen	206	—
♂	-	29/8 06	Rypefjeldet	206	—
♂	-	6/9 06	Kap Bismarck	201	—
♀	-	11/3 07	Hvalrosodden	200	Measured on the fresh bird.
♀	-	17/3 07	Thermometerfjeldet	200	—
♀	-	25/5 07	Hvalrosodden	201	Measured on the skin.
♀	-	26/5 07	Rypefjeldet	182	—
♀	-	15/8 07	Pladen	187	—
♀	-	15/8 07	—	187	—

Red-throated Diver. *Colymbus septentrionalis* L.

The Red-throated Diver occurred very commonly in summer as well near the coast as far up in the country. It was also to be seen at the mouth of the rivers and — though more rarely — in small gulfs and fjords.

Koch and Bertelsen did not meet with it farther North than lat. 80° 30′ n. (June 9th 1907).

Mylius-Erichsen undertook a boat excursion along the coast while the ship was bound in the ice a little North of Kap Bismarck, and here he observed a flock of 9 flying Divers.

He took them to be *Colymbus glacialis* but the precise description of the size, cry and flight of the birds makes me believe, that they were *C. septentrionalis*[1].

The Divers arrived at the lakes by the ship's-harbour and at Stormkap in the first half of June. In 1907 the first Diver was noticed June the 8th, in 1908 three days later. Solitary males appeared first; they were flying extremely high uttering a very strong resounding cackling, while they searched for open water, which was very scarce on the first days after their arrival.

Even in the smallest ponds the Divers were to be seen among *Somateria spectabilis* and *Pagonetta glacialis*; but they very rarely visited cracks or openings in the sea-ice.

I did not find the Divers breeding in the summer 1907, but they stayed in couples for a long while at the breeding places. The number of birds corresponded to what I had noticed in 1906. In 1908 I found this species breeding whereever acceptable localities were at hand: Larger or smaller fresh water ponds with fully or partly grass-clad beaches.

As the chicks are not, like those of the King-Eider and the Long-tailed-Duck, brought to the salt water, the breeding places will sometimes be chosen far from the coast.

July the 6th the first nest was observed near a little lake close to the ship's-harbour; it was placed hardly 100 meter from the coast and contained two but little incubated eggs.

The breeding bird proved extremely shy and flew from the nest when I appeared, at a distance of some 200 meters; it mounted to a great height circling over the surface of the lake all the while uttering its cackling and then took to the water far out in the bay, from which it returned after a quarter of an hour or so to resume its anxious cackling and circling high over the nest.

After my departure from the lake the bird rushed down into the water almost vertically, executing the peculiar twisting movements, which are so characteristic of the flight of this species; then it swam rapidly to the nest.

The male would usually stay in a lake close by. The majority of the breeding females which I observed later on were not so shy;

[1] The great Northeren Diver was only once observed with certainty in North-East Greenland.

upon my arrival they would only swim out in the lake, from which they, accompanied by the males, uttered a hideous screaming or mewing and awaited my departure.

All the nests I found contained two eggs. These vary somewhat, however not so much in colour as in size and shape.

The nests were almost always placed under similar conditions: Close to the water in places sparsely overgrown with grass or other vegetation.

The nest is built of half rotten stalks of plants fetched from the bottom of the low water near the nest and soaked with water; a few fresh stalks, cut off by aid of the bill of the bird, are placed around the border of the nest.

July the 10^{th} I observed a female busy in building her nest; this was ready the next day, but it took 5 days before the first egg was laid. One day later the bird was brooding on two eggs.

Two almost full-grown young ones still guarded by the old female were secured September the 4^{th} 1906 on a pond at Snenæs. The greater part of this pond was already covered with new ice.

A great many Divers used to settle in Lakseelven as well as in its mouth, the bay and the surrounding lakes. They fed mainly — almost exclusively — on the common Northern Charr (*Salmo alpinus*) which occurred in vast numbers in these places. Nearly all the fresh-water lakes also contain great numbers of trout.

I very often found remnants of plants in the stomachs of those Divers, which were shot soon after their arrival when the birds had to content themselves with pools of melting snow and other small ponds.

The Diver has a pugnacious temper and is quarrelsome especially against birds of its own kin.

I could daily observe the habits of the Divers at my summer station at Stormkap as well in the ponds up country as in the mouth of Stormelven, where the birds resorted for fishing at certain times of the day. While lying on the water the bird utters a hideous sound rather like the mew of an angry cat, but during its high, beautiful rapid and enduring flight it utters a strong cackling.

I have seen them circling in the air for hours until they — called by a screaming companion — swift as lightning rushed down through the air finally landing with an audible splash in the water sliding a long way on the surface.

Immediately the melodious cackling changes to a most hideous mewing, which is uttered for some moments by the bird which has descended and the companions which have called it down.

The Divers vary greatly in size. As a rule the males are by far the largest.

This species always appears in North-East Greenland in full summer plumage.

For the zoological museum in Copenhagen was collected the skins of 3 old birds and one almost full-grown young one and two eggs.

The following measures have been taken:

Sex	Age	Date	Locality	Wing mm.	Bill mm.	Tarsus mm.
♂	ad.	17/8 06	Kap Bismarck	289	53	71
♂	-	27/8 06	Hvalrosodden	278	53	71
♀	-	18/7 07	The ship's-harbour	267	52	68

Eggs.

Date	Locality	Length mm.	Breadth mm.
6/7 08	The ship's-harbour	67	43
		70	43

Great Northern Diver. *Colymbus glacialis* L.

Only once I met with this species.

While I stayed on Hvalrosodden from August 20th to September 2nd 1906 I observed 5 Great Northern Divers every day lying in Dove Bugt usually not far from the coast and just off my tent; they were all old birds in summer plumage and extremely vigilant and shy. My attempts to get within gun shot failed even when they had retired to rest on the pack-ice by the shore.

When the Divers were searching for food and observed no danger they were so busy in their work, that they only appeared on the surface for a few moments.

Their power of submergence is great and seems to exceed by far that of *C. septentrionalis.*

The Great Northern Diver breeds farther South on the East coast (According to Bay: Meddelelser om Grønland, Vol. 19, 1896, it is common at Scoresby Sound) but appeared only as an accidental visitor in North-East Greenland. I very much doubt that it breeds here, and this I think is due to the fact, that the large deep mountain lakes, the favorite breeding localities of this species, only very late in the season — in some years never — become free from ice.

Fulmar. *Fulmarus glacialis* L.

According to KOCH and BERTELSEN the Fulmar was nesting in great numbers on a steep, inaccessible rock some 500 meters high — facing the sea — Mallemukfjeldet (lat. 81° 12′ n.). Some of the birds belonging to this nesting colony appeared already in the middle of April at the shore from lat. 79° 45′ n. to 80° 20′. Although it was so early in the season, several spots with open water were found here.

A solitary Fulmar would now and then appear outside this part of the coast, but only about the isles and skerries lying farthest out from the shore and in dense fog. — Inside the firths it would never come.

As well during the outward as the homeward navigation through the pack-ice, I could daily observe Fulmars, which with great audacity and without the slightest bit of fear, came to the ship to get a part of the offal, which was thrown out. In closely packed ice with but few openings only solitary flying birds were to be seen, but on stretches, where the ice was drifting in smaller scattered flakes the Fulmars would join in flocks counting sometimes as many as 20 birds; the flocks rarely contained a greater number.

They used to lie in the wake of the ship zealously quarreling over the bits of blubber thrown out for them.

While in the Atlantic the Fulmars were rather reserved and would never come close to the ship, they proved so fearless in the ice, that pieces of blubber, which I handed them, were snatched from my hands. In the wake I could catch so many of them, as I wanted, by aid of a bent pin as hook and a piece of blubber as bait. As soon as a captured bird was let free, it would immediately go on the hook again.

From the surface of the sea the birds would dive — using their wings with great dexterity — for sinking pieces of blubber, sometimes to a depth of more than one meter. They would never try to dive by plunging. When captured a Fulmar will defend itself bravely by aid of the bill; they often struck my hand so hard, that the blood would run.

When I placed a Fulmar on the deck, it would immediately lie down and seemed not to be able to stand on its feet, neither did I see them stand, when they came to a carcass of a seal lying on a flake of ice. They only moved slowly forward awkwardly creeping or wriggling their body. They only succeeded in getting on their wings again by creeping to the edge of the ice or by plunging in the water. They were not able to fly up from the deck of the ship.

When captured the Fulmars will eject a stinking clear juice like train-oil; this will quickly make their usually clean feathers dirty.

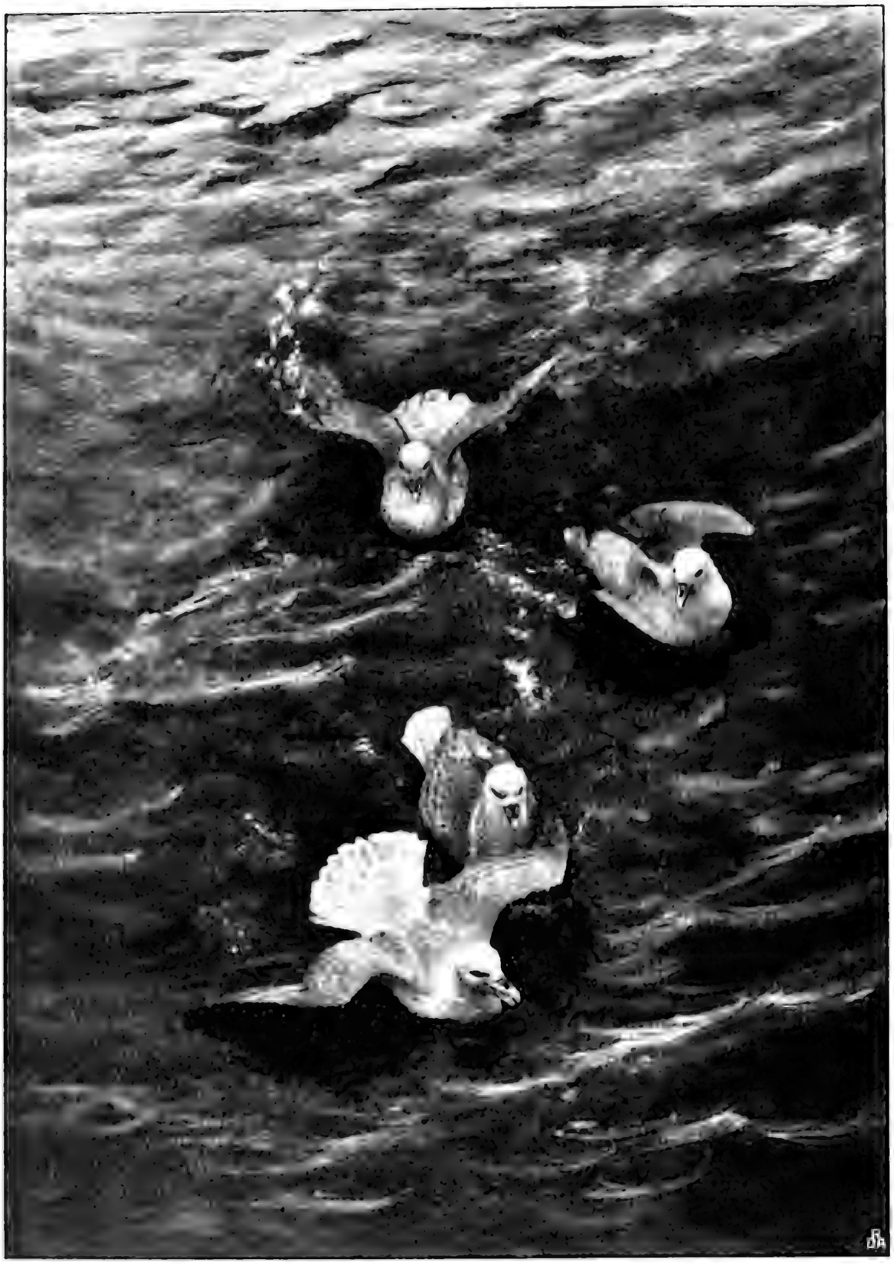

Fig. 3. Fulmars in the wake.

Nearly all of the captured and shot Fulmars had a pronounced breeding spot.

In the stomachs of killed Fulmars I found always mainly jaws of cuttle-fish, in some of them also remnants of smaller crustaceans.

The question regarding the existence of a pale and a dark form of the Fulmar and the geographical distribution of these as well as the difference between them, has, so far as I know, received little answer. I therefore think, that the observations regarding these points, which have been undertaken by myself and my companions on the northward voyage may be of interest.

I shall first relate what my companions have noted down by Mallemukfjeldet and the environments of this and must state, that before these gentlemen departed, I pointed out to them what special informations I wanted about birds observed, and that they with regard to the Fulmar ought to note the total number and the proportion between pale and dark individuals.

April 17th 1907. Lat. 79° 45′ n. 5 or 6 Fulmars were observed, they were all dark. Only few open spots in the ice.

KOCH and BERTELSEN.

April 20th 1907. Mallemukfjeldet lat. 80° 12′ n. The Fulmars were present in greater numbers — by hundreds but not by thousands; they settled high up on the rock at the nesting-places. Birds, which flew out, always flew (in an eastern direction) towards the open water. By far the most birds were dark.

KOCH and BERTELSEN.

KOCH and BERTELSEN report further from the voyage back to the ship:

June 8th & 9th lat. 80° 23′ n. "In the open water along the shore were many Fulmars. Dark birds".

June 9th & 10th lat. 80° 20′ to 80° 10′ n. "Fulmars in great numbers, much greater than on the voyage upwards. Still almost exclusively dark birds".

(Dr. LINDHARD and G. THOSTRUP arrived at Mallemukfjeldet October 15th 1907; they stayed here for three days; though there was much open water near the mountain, the Fulmars had quite disappeared.)

My own notes concerning the colour of the Fulmars observed on the voyage outwards, when this species appeared at first — a little North of the Shetland Islands — till we anchored by Kap Bismarck are the following:

July 9th 1906. Lat. 61° 11′ n. long. 1° 18′ w. *Fulmarus glacialis* appeared for the first time. But 3 to 4 birds were seen at one time all vere pronounced pale.

July 11th 1906. Lat. 61° 46′ n. long. 5° 26′ w. Some Fulmars can always be seen, some of them flying around the ship and some lying in the wake. Never larger flocks and always pale birds.

July 13th 1906. We passed to day Store Dimon and Lille Dimon and saw a lot of Fulmars; they were all pronounced pale.

July 23rd 1906. Atlantic. Lat. 65° 26′ n. long. 12° 12′ w. Every day some solitary flying Fulmars by the ship. Exclusively pale birds.

July 24th 1906. Lat. 66° n. long. 11° 56′ w. Among some pale Fulmars I observed to day one dark; it seemed to be a little smaller and to have its wings a little shorter than the pale birds observed before.

July 25th 1906. Lat. 67° 1′ n. long. 11° 10′ w. Near the ship was lying a flock of some 30 Fulmars; but two of them were dark.

July 27th 1906. Off Jan Mayen. Many Fulmars. Most of them pale.

July 28th 1906. Lat. 71° 28′ n. long. 5° 8′ w. To day a greater number of Fulmars than any day before. The pale form is still by far the most common.

July 30th 1906. Lat. 74° 30′ n. long. 3° 15′ w. The pack-ice. Many Fulmars close to the ship and in the bilge-water. It seems as if the dark form is now the predominating.

July 31th 1906. The pack-ice. About lat. 75° n. Observed to day some 50 Fulmars; some 75 % of them were typical dark; a few birds formed a transition to the pale, the others were pale.

August 1st 1906. The pack-ice. We continue to feed the Fulmars from the ship. Almost all of them are dark.

August 3rd 1906. Lat. 75° 56′ n. The pack-ice. The Fulmars appear now almost always solitary. Exclusively dark birds.

August 4th 1906. Lat. 76° 10′ n. The pack-ice. Still exclusively dark Fulmars.

August 8th 1906. The pack-ice. Single Fulmars. Dark birds.

August 9th 1906. One dark Fulmar.

August 11th 1906. Lat. 75° 50′ n. long. 16° 10′ w. The pack-ice. 3 Fulmars seen; 2 of them dark and one pale. (A very small bird.)

August 12th 1906. The pack-ice. This morning one little pale Fulmar near the ship; perhaps the bird seen yesterday. To day we have proceeded rather near to Koldewey Islands.

August 14th 1906. Lat. 77° n. The pack-ice. One solitary dark Fulmar.

August 15th 1906. Lat. 77° 19′ n. The pack-ice. Enormous packs of ice in North. One pale and very small Fulmar, that seems to

be somewhat smaller than the pale birds from the Atlantic. Unfortunately I am prevented from securing the bird. I saw this forenoon a typical dark Fulmar.

My notes from the voyage homewards correspond exactly to what is said above, and thus confirm my supposition, that this species appears in two forms a southern pale form and a northern dark one; there may be a few deviations from the rule and perhaps smooth transitions from pale to dark.

I therefore find it unnecessary to cite the notes from the voyage homewards also.

Judging from birds examined, I think that in the dark form the bill is as a rule shorter and more slender than in the pale. This can especially be said of the hook of the bill, which — as other parts of the bill — is also paler couloured than in the pale form. The dark spot before the eye exists in both forms. The total size of the birds differs so much in both forms, that no fixed difference can be stated in this respect.

It may be supposed, that pairing between pale and dark Fulmars takes place. The fact, that at Mallemukfjeldet, where the one form so decidedly predominated, birds of the other form were also seen, only confirms the above mentioned supposition.

For the zoological museum in Copenhagen were collected the skins of 6 Fulmars, on which the following measurements have been taken.

Sex	Age	Colour	Date	Locality	Wing mm.	Bill mm.	Tarsus mm.
♂	ad.	pale	31/7 06	The pack-ice. Lat. 75° n. long. 8° w.	303	42	55
♂	-	—	31/7 06	—	307	39	55
♂	-	—	31/7 06	—	In moult	41	52
♀	-	medium coloured	24/7 06	The northern Sea	307	36	49
♀	-	dark	31/7 06	The pack-ice. Lat. 75° n. long. 8° w.	315	36	50
♀	-	—	31/7 06	—	315	33	50

Ringed Plover. *Ægialitis hiaticula* L.

The Ringed Plover occurs more commonly than any other wader and is — with exception of the Snow-Bunting — the most frequently occurring bird in N. E. Greenland.

I met with nesting Ringed Plovers everywhere, even on places so desolate, that no other bird would try to exist there.

The surroundings of the ship's-harbour offered excellent localities for this species and here I found it most numerous; at least 100 couples nested here in the summer of 1908.

I also found it frequently nesting in the 60 km. long district between Stormkap and Mørkefjord and on Koldewey-Islands and certainly of more common occurrence than anywhere in Denmark.

The Ringed Plover arrived on the same day as the other waders. Gradually as the snow melted this species resorted to sandy spots without any vegetation, which are scattered around in the country; but also on low irrigated slopes and along fresh water beaches this bird occurred frequently.

The pairing took place a little later than with other waders. On the before mentioned sterile "sand-islets" I found the majority of nests observed; but the Ringed Plover in Greenland is however not more consistent in its choice of a nesting place, than it is elsewhere.

Nests were found as well near the coast as far from it and even rather high up the rocks.

Eggs were found within the time from June 17th to July 18th; the number in a clutch was always four, and they can not be distinguished from European eggs of Ringed Plovers.

The old birds leave the country in pairs as soon as their young ones are grown up, as a rule in the first week of August; these will then immediately go to the shore and mouth of rivers and join the company of other young waders especially Sanderlings and Turnstones. In the first week of September they depart, some of them a few days earlier; September 9th I observed the last.

The old and the downy plovers principally eat insects and their larvæ and pupæ.

I have however also found remnants of plants in the stomachs of old birds shot at few days after their arrival. The young birds feed principally on crustaceans and worms, which animals especially in August are abundant on the sandy shores of bays and firths.

The Ringed Plovers from N. E. Greenland are — according to my experience — in no way distinguishable from European ones.

For the zoological museum in Copenhagen were collected the skins of 3 old birds and in spirit 2 old and 3 young birds and 3 downy young ones; also 12 eggs. (3 clutches.)

The following measurements have been taken:

Sex	Age	Date	Locality	Wing mm.	Bill mm.	Tarsus mm.	
♂	ad.	?	?	130	15	26	In spirit.
♂	-	2/6 07	Stormkap	128	15	27	In spirit.
♂	-	17/8 06	Harefjeldet	126·5	14	26	
♀	-	4/6 07	Stormkap	136·5	15	26	
♀	-	1/6 08	—	133	14	27	

Eggs.

		Length mm.	Breadth mm.
June 22th 1908. Snenæs (slightly incubated).	1	35	26
	2	35	26
	3	36	26
	4	36	25·5
June 19th 1908. The ship's-harbour (slightly incubated).	1	35	26
	2	35	26
	3	34	26
	4	35·5	26·5
June 29th 1907. Thermometerfjeldet (fresh laid).	1	36	25
	2	36	26
	3	36·5	25·5
	4	37	26

Turnstone. *Strepsilas interpres* L.

Nesting very commonly almost everywhere.

The Turnstone occurred most commonly on the stretches between Stormelven and Hvalrosodden. In the immediate surroundings of Stormkap I counted some 40 nesting couples in the summers of 1907 and 1908.

The Turnstone would often nest on the larger table-lands 5 to 6 km. from the shore.

June 8th and 9th 1908 I met with several couples on the moor lying N. of Trekroner — indeed very far from the sea. At this time the breeding had not yet begun, and the birds stayed at the ponds of melting snow.

Strange to say this bird did not nest in the surroundings of Danmarks Havn, though excellent localities apparently were at hand. A great many Turnstones settled just after their arrival on the moor North of the ship's-harbour, but they gradually left this place as the pairing took place. Now and then I observed a Turnstone on smaller islands and skerries, but never nesting.

An old female was shot May 22nd 1907 on Renskæret. [Near the field-ice]. In the stomach of this bird I found only remains of plants. The early arrival of this specimen may certainly be considered accidental, as the coming of this species — like that of other waders — was very regular; they arrived indeed all on the very same day and hour; as before said, in the two summers respectively June 2nd and May 28th.

Just after their arrival the Turnstones will mainly feed on vegetable food. However I often saw them run about on the snowless spots of stony plains busied in turning stones under which they found larvæ and pupæ. As the birds were very confiding, I quite often succeeded in observing them while executing this interesting work at a very short distance. The birds would with incredible dexterity put their bills beneath flat stones and by a rapid toss with the head turn them over and then quickly pick up what was found beneath. I have seen the Turnstone in this manner turn over flat stones of the size of the palm of my hand. I have also seen young birds working in the same manner when running along the shore.

The pairing continued till the middle of June. The Turnstone nests on almost the same localities as the Sanderling and the Knot, but as a rule prefers to build its nest near an innundated tract, a bog or a fresh-water-pond to which the young ones are often led. Both male and female breed and the breeding spots are of equal developement in the two sexes.

When a hatch of young ones grows up the male will leave it and join the party of other birds of its own kin, Sanderlings and Knots; together with these birds they leave the country about the middle of July.

The parents are very watchful against danger in the breeding time and when the young ones are small. One of them will keep a look-out from the summit of a large stone or a rock, while the other is breeding or guiding the young ones. The bird on guard will discover an approaching enemy at an incredibly long distance and rush towards him uttering furious cries. Especially the Skua (*Lestris longicauda*) is a detested enemy of the Turnstone. Every day I could observe the hunting Skuas pursued by Turnstones. When one pursuer returned to its district another would appear and thus every Skua was almost always accompanied by at least one Turnstone. Also towards the Polar Fox the Turnstones would betray great fear and they would often join from afar and swoop down on the hated enemy uttering their sharpest and most violent cries.

Towards the end of July the young ones were able to fly but

were however generally accompanied by the old female. The young ones would often resort to the upper part of rather high rocks while the old female incessantly crying and anxiously flapping tried to divert my attention from them. When the old female had left her offspring and the country, these would immediately take to the coast and the mouths of rivers like other young waders.

At the end of August this species leaves the country alltogether only some few individuals staying a little longer.

Analyses of stomachs have proved, that old Turnstones feed on vegetable as well as animal food.

In the stomach of a little nestling killed July 12th 1908 I found larvæ of *Chironomidæ* and other, indeterminable, larvæ of insects. In stomachs of fledglings I most frequently found *Gammarus*, in a single bird larvæ of *Chironomidæ* (August 17th Kap Bismarck).

The Turnstone from N. E. Greenland does not in any way differ from that from Europe.

For the zoological Museum in Copenhagen were collected the skins of 4 full-grown birds. In spirit 4 full-grown birds and one downy young. Also 12 Eggs (3 clutches).

The following measurements have been taken:

Sex	Age	Date	Locality	Wing mm.	Bill mm.	Tarsus mm.	
♂	ad.	21/6 07	Stormkap	155	24	28	In spirit.
♂	-	11/6 07	—	152·5	22	26	
♀	-	4/6 07	—	156	23	27	
♀	-	11/6 07	—	147	21	25	
♀	-	27/5 07	Renskæret	144	22	24·5	

Eggs.

		Length mm.	Breadth mm.
June 29th 1908. Stormkap. Highly incubated.	1.	41	30
	2.	41	29
	3.	40	30
	4.	40·5	30
June 29th 1908. Stormkap. Highly incubated.	1.	40	30
	2.	39	30
	3.	40	30
	4.	40·5	30
June 30th 1908. Stormkap. Highly incubated.	1.	38	29
	2.	38	29
	3.	40	29
	4.	38	29

Purple Sandpiper. *Tringa maritima* L.

I met on the expedition only three times with solitary Purple Sandpipers, though these birds occur frequently in so many other places in Greenland.

June 11th 1908. By Havlitsøen on Stormkap I met with an old male, which walked on the beach of the lake in company with a Sanderling.

June 15th 1908. On a plain by Stormkap I observed an old female in company with a *Tringa alpina.*

June 17th 1908. On the moor by the ship's-harbour an old female walked amongst some other small waders.

The skins of the two last mentioned birds were brought home for the zoological museum in Copenhagen.

Brønlund mentions in his posthumous diary that a flock of small waders was observed on the shore of Mylius Erichsens Land. Judging from the description, these birds may have been *Tringa maritima.*

However I consider the Purple Sandpiper to be only an accidental visitor to the tracts explored by the expedition.

On the two birds collected, the following measures have been taken:

Sex	Age	Date	Locality	Wing mm.	Bill mm.	Tarsus mm.
♀	ad.	15/6 08	Stormkap	130	32	23·5
♀	-	17/6 08	—	126·5	33	22·5

Knot. *Tringa canutus* L.

Through the whole of the summer the Knot resided in the country between Stormelv and Snenæs — a tract some 10 km. long. I only exceptionally saw the species outside this place and never far from it, though I found the same sort of conditions in several other districts. It is, however, not impossible, that a few couple may nest in the district N. and W. of Hvalrosodden, where excellent localities are to be found; here I twice met with old birds.

The sledge parties of the expedition did not with certainty observe this species.

When I visited Stormkap and the surrounding country the first time (August 18th 1906), I found here and there on the sandy fresh-water banks and on the irrigated sandy slopes foot-prints of the Knot, but by this time the birds themselves had already left the country.

In the summers 1907 and 1908 I met with Knots in these regions, apparently every year the same some 30 couples. In spite of all my efforts I did not suceed in finding any nest; the vastness and monotony of the territory afforded great difficulties, and besides I was perfectly ignorant of the behavior of this species in the breeding season. My careful observations and the examinations of birds killed at different times render me able to say with certainty, that this bird — generally so little known at its nesting quarters — does breed here.

The Knots arrived at the Stormkap territory in couples at exactly the same time as did the other waders; in the two summers respectively June 2nd and May 28th.

While the Sanderlings, Dunlins, Turnstones and Ringed Plovers immediately took to the sparely occurring spots free from snow, the Knots would prefer to go to the still snowcovered hollows in the marshes and moors, where I saw them running on the snow eagerly occupied in picking up the seed of *Carex*- and *Luzula*-tufts the ends of which here and there appeared over the snow. This sandpiper, more than its relatives, feeds on plants at certain seasons.

In the first days I also observed now and then a couple of Knots on snowless spots on elevated table-lands and even on the top of the high gravel banks at Stormkap. These may however have settled there in order to rest after the voyage and not to search food. As soon as ponds of melting snow and fresh-water beaches free from ice were to be found, the Knots would resort to these, and here the birds wading or swimming looked for animal diet. In this season the Knot did not appear on the salt water shore — like other waders.

Gradually as more extensive stretches of low lying table-land became free from snow, the Knots occurred more frequently here in their real nesting quarters; they would however still for a while often visit moors and marshes with a rich vegetation of *Cyperaceæ*.

Peculiar to this species is its restless character.

The resident couples would every day make long excursions, not only to seek food, but probably also for pleasure. Their great power of flight makes them able to do this without difficulty. In rapid high flight they are now here and now there. I often saw them set out in a northern direction high over the summits of the mountains or in a southern far out over the ice in the firths, to return after a short while. More than the other waders the Knots keep strictly in couples immediately after their arrival; examinations of the sexual organs of birds, killed just after their arrival, proved, that the breeding time was near. The testicles of the males were

extremely swollen and the ovaries of females contained eggs, which were relatively considerably larger than in other waders.

The pairing notes of the males filled the air everywhere a few hours after their arrival.

The male suddenly gets up from the snowclad ground, and producing the most beautiful flute-like notes, following an oblique line with rapid wing strokes, mounts to an enormous height often so high, that he can not be followed with the naked eye. Up here in the clear frosty air he flies around in large circles on quivering wings and his melodious far sounding notes are heard far and wide over the country bringing joy to other birds of his own kin. The song sounds now more distant now nearer when 3 or 4 males are singing at the same time. Now and then the bird slides slowly downwards on stiff wings with the tail feathers spread; then again he makes himself invisible in the higher regions of the air mounting on wings quivering even faster than before.

Only now and then the observer — guided by the continuing song — succeeds for a moment in discerning the bird at a certain attitude of flight, when the strong sun-light falls upon his golden coloured breast or light wings.

Gradually, as in increasing excitement he executes the convulsive vibrations of his wings, his song changes to single deeper notes — following quickly after each other — at last to die out while the bird at the same time drops to the earth on stiff wings strongly bent upward. This fine pairing song may be heard for more than a month everywhere at the breeding places, and it wonderfully enlivens this generally so desolate and silent nature. The song will at certain stages remind of the fluting call note of the Curlew *(Numenius arqvatus)*, but it varies so much with the temper of the bird, that it can hardly be expressed or compared with anything else. The notes here given represent the theme, which is varied in the song.

Tringa canutus's pairing song.

The bird principally sings in the afternoon, when the weather is clear and tranquil.

It may, however also be heard at other times of the day even in severe snow-squalls and at midnight.

I never succeeded in observing the pairing-act itself.

Solitary flying males, which, judging from their behaviour and direct flight, were on migration farther North, would in the first days of June utter flute-like notes. These notes sounded like the beginning of the pairing-song, but were not so passionate and may perhaps be understood as a sort of call notes. The real call note of this species is short and growling and the same for both sexes.

In the breeding season the male is pugnacious and quarrelsome against birds of its own kin as well as against other small birds, which appear within his domain. Uttering a short cry he will fly up and pursue the intruder in the most violent manner and often he would follow it so far away, that I could not see them even through my field glass. He would soon return and having — triumphantly fluting — circled around several times, go down to his mate.

Fig. 4. Ovary of Knot. Killed June 10th 1907.

I have seen the Knot pursue even Skuas.

Already June 10th I found an almost fully developed egg in a shot female. From the middle of June I often met with females, the behaviour of which made me suppose with certainty, that they had commenced to breed. In such birds I found well-marked breeding spots, and but quite small eggs in the ovaries. All the breeding birds observed behaved in nearly the same way. When I carefully walked over a larger table-land a bird would suddenly appear just before my feet, rushing silently and as secretly as possible away between stones and following furrows in the earth. When I — having vainly searched for the nest — rapidly followed the bird, this would with a short call fly high up in the air, disappear for some moments and again appear a little farther forward on the plain, where it continued its silent running as it seemed without the slightest inclination to go to the nest. If at last I secured such a bird it always proved to be very thin and to have breeding spots — certain signs, that it had eggs or young ones. I have from an ambush watched such birds for hours, but I never succeeded in getting them to show me their nest.

The breeding localities were quite the same as those of *Calidris arenaria*: Dry, stony, sparsely covered table lands with clay or sand-mixed ground. I met, however, always with the supposed breeding-birds on rather extensive plains and not on the small "stone-islets"

in the moors, a fact that — as already mentioned — made my searches after the nests more difficult.

I met with breeding birds as well South as North of the gravel banks plateau in the Stormkap territory, but I never found them close to the shores of the firths.

In the most favoured localities I found some old nests the size and situation of which made me suppose, that they had belonged to Knots. These nests were very similar to those of *Strepsilas interpres*, the only bird with which a confusion could be possible, and they also were placed on similar spots, but my knowledge as to the Turnstone and its nest is so intimate, that I nevertheless by the total impression feel certain, that I am able to distinguish it from that of any other bird.

I found breeding spots in both sexes.

The males seemed only to partake in the breeding for a shorter part of the day; this I judge from the fact, that during the breeding season I met with males far more frequently than with females at the side of lakes and other feeding places lying far from the nesting localities.

The care of the young ones is — according to my experience — entrusted to the female alone.

The night between July 25th and 26th 1907 I met with a Knot, that quite certainly had young ones on a plain traversed by a deep, partly dry river bed. The bird suddenly appeared just before my feet, flapping and creeping pitifully along with puffed-up feathers. It produced now and then some — to me hitherto quite unknown — peculiar mouse-like, hardly audible sounds, that at last sounded as an anxious long drawn out piping.

Hidden behind a large stone I awaited for a long time the bird's return to her young ones but quite in vain. She soon came back to the stone still anxiously creeping and piping, but finally she flew up and with an incredibly rapid low flight followed the bed of the river in a western direction and disappeared alltogether.

I searched for a long while for the young on the spot, where the female first appeared, but in vain. Then I followed the bed of the river in the direction in which the bird flew and found it some 500 meters farther West, still pitifully creeping and piping. By continually flying a shorter or longer way in the same direction, she tried to lure me as far away as possible. Having continued a couple of hours, we were at last some two kilometer from the place, where the bird appeared at first. As I was thinly dressed, I was at last obliged to go to my tent to get on some warm clothing as protection against the night-cold.

When I returned, the bird had completely disappeared. I suspect this bird had rather large young ones, which perhaps were able to fly; if not, they would hardly have been able to resist the night-cold without the protection of their mother; she may at first unperceived have flewn towards me and met with me far from the place, on which the young ones were lying. The disturbance caused by my presence may have disposed the bird to think it advisable to use my absence of some 4 hours to guide away her young ones as far as possible and they may before my return have left the tract which I explored.

August 8th in the same year I met with another bird, the behaviour of which was very like that just described, but also this time I failed to find the young ones.

I did not see any old bird later than August 8th.

August 22nd I observed and secured 3 young on the shore by Hvalrosodden some 20 kilometer from Snenæs. These were all quite able to fly, but two of them had still plenty of down left around the root of the bill. In company with some young Sanderlings they sought food on the wet sand, where sandhoppers (*Gammarus*) were abundant.

From the end of June I every day observed some Knots wandering around in small flocks, which in the beginning counted only some 3 to 4 birds, but later on as much as 10 to 11 individuals. They sought food in company with small flocks of Sanderlings and Turnstones on table-lands and by shores of lakes. They very often could be met with on the lowest edge of large old snow-drifts, the melting of which now took place at a rapid rate.

The birds so obstinately stuck to such places, that they could not be scared away even by shots. To be sure they did fly up and circled around for a while high in the air, but they soon came down to the very same spot, which they left, even if I was standing close by.

Also the males, the song of which could still be heard at the nesting-places, would sometimes for a while join the flocks by the snow-drifts. The food, which the birds were seeking here was certainly vegetable; judging from examinations of stomachs it consisted mainly of green algæ.

The quarrelsomeness, that characterizes the males at their nesting-places, was never expressed during their participation in these excursions.

The Knots wandering around would leave the country a little before the middle of July.

The last days before their departure the birds proved unusually

shy and were often to be seen tumbling in flocks enormously high up in the air. Birds shot out of such a flock generally proved to be males nearly all of them with breeding spots; this also seems to indicate, that the males after having had their share of the breeding duties, leave the further care of the offspring to the females.

The Knots arrive in Greenland in full summer plumage. The feathers on the back and the crown of the head by wear and tear in summer alter their colour to some degree as the pale edges of the feathers disappear, whereby the bird looks darker on these parts.

In some birds more or less white feathers scattered all over breast and belly were found. It is well-known, that no difference in exterior between the two sexes can be pointed out.

For the zoological Museum in Copenhagen were collected the skins of 6 old and 3 younger Knots, and one old bird in spirit. The following measurements have been taken:

Sex	Age	Date	Locality	Wing mm.	Bill mm.	Tarsus mm.	
♂	ad.	27/6 07	Stormkap	176 (left) / 172 (right)	34	31·5	
♂	-	24/7 07	—	159·5	33	31	
♂	-	5/7 07	—	159	32	31	
♂	-	25/6 08	—	157	32	29	
♀	-	2/7 08	—	170	33·5	29·5	
♀	-	4/6 07	—	169	33·5	31·5	
♀	-	9/6 07	—	164	34	30	In spirit.
	juv.	22/8 07	Hvalrosodden	167	33·5	31·5	
	-	22/8 07	—	163	27	29·5	
♀?	-	22/8 07	—	162·5	27	27·5	

Dunlin. *Tringa alpina* L.

The Dunlin occurred almost as commonly as the Sanderling; it nested all over where larger or smaller bogs, moors or marshes covered with tufts of grass or other vegetation were at hand. Excellent localities existed at Danmarks Havn, where more than 50 couples had settled, at Stormkap (30 couples) at Snenæs and at Hvalrosodden.

June 8th and 9th 1908 I visited a large moor far inland — N. of the mountain Trekroner — and observed here 30 to 40 couples of Dunlins. The localities here were as attractive to the bird as

they could be: The snow had melted early in the season, and consequently innumerable fresh-water pools were at hand; the vegetation was more luxuriant than in any other spot in this country, and the insect life was correspondingly rich. I also observed Dunlins on Koldewey Islands at Kap Marie Valdemar and at many other places.

On small islets this bird occurred only exceptionally but on the other hand it occurred commonly enough far from the shore on extensive table-lands with scattered bogs.

The Dunlins arrived usually in couples at the same time as the other waders. (With exception of the Grey Phalarope.)

As the Dunlins almost exclusively feed upon animal food it was extremely hard for them to make a living just after their arrival. These birds would not go to the snowfree spots on stony plains as Turnstones, Ringed Plovers and Sanderlings used to do and they would not go on the snow as did the Knots to pick up seeds of plants sprouting through it. The life of the Dunlins was confined to the open water and swampy soil, therefore they were permanent visitors by the ice-free beaches of small sheets of fresh water and pools of melting snow.

The pairing took place in the first half of June. The eggs first found date from June 14th. Downy young could be found everywhere at the nesting-places in mid July.

I found a Dunlin's nest containing 4 strongly incubated eggs on Snenæs August 4th 1907, but this must be considered quite abnormal, and young ones hatched so late will hardly be able to leave the country in time.

The same day I observed — also on Snenæs — two hatches of fledglings.

The nests are most frequently built on hillocks with long grass. I found, however, not seldom nests of Dunlins on small islets covered with short grass, but always near to or surrounded by shallow water. The Dunlin's nest is often placed on similar spots and has the same exterior as that of the Phalarope, but it can easily be distinguished as the bottom of the Dunlins nest is always lined with a few withered leaves of *Salix arctica*, while the Pharalope uses bent straws as layer for its eggs.

On spots, where many Dunlins nest, several newly scratched but half finished nests may always be found; they are probably left because the birds have found the ground too wet.

The Dunlins like to nest on moors and bogs partly irrigated by melted snow streaming down from the rocks. On such places I found many nests with eggs and new-born downy young which

were lying close together in broods carefully guarded by the old female, on isolated larger hillocks surrounded by the ice-cold snow-water. When the flood of melting water is unusually strong such localities may be completely innundated, and then not only the eggs but also the frail young ones, which are not yet able to save themselves by swimming through the cold water to dry spots, will be destroyed.

This happened in summer 1908 for instance in the marsh North of the ship's-harbour; this was to a great extent innundated by melted snow rushing down from the rocks. Several nests and young of Dunlin were lost on this occasion. Both sexes partake in the hatching act and the male may also be seen near the young ones, the guarding of which is mainly left to the female.

This species will — according to my experience — leave the country in families as soon as the young ones are strong enough to migrate — usually in the first half of August.

I only once met with a young Dunlin at the shore; it had joined a party of some Sanderlings. I have never seen old Dunlins at the salt water shore.

This fact certainly disagrees with the observations made by Bay in the Scoreby-Sound regions. Here the Dunlins are said to "occur in multitudes in the meadows at the sea at the "Mudder-bugt" August 25th to 28th". ("Meddelelser om Grønland", Vol. 19, 1896, Page 29.)

Consequently the Dunlins behaved here as did the Sanderlings 7 degrees farther North.

The food of the Dunlin is — as already mentioned — essentially animal. In stomachs examined were found decomposed indeterminable pieces of chitin. In the stomach of an old bird shot June 24th were found unmistakable remnants of pupæ of muscidæ, and spiders. Remnants of vegetable origin were never found.

I am not able to distinguish Dunlins from North-East Greenland from those of Europe, neither as to their size, plumage, voice nor their mode of living. Neither as to the eggs nor to the downy young ones can any difference be pointed out. (A clutch of eggs, the colour of which differs much from the usual has been brought home.)

For the zoological museum in Copenhagen were collected the skins of three full-grown birds and in spirit 4 full-grown birds and 6 downy young. Furthermore 15 eggs (4 clutches). The following measurements have been taken:

Sex	Age	Date	Locality	Wing mm.	Bill mm.	Tarsus mm.	
♂	ad.	4/6 07	Stormkap	110	27	22	
♀	-	2/6 08	—	111·5	31·5	26	
♀	-	10/6 08	—	107	29	23	
♀	-	24/6 07	—	115	33	24	In spirit.
♀	-	27/6 07	—	111	31	23	—
♀	-	2/7 07	—	111	31	24	—
		20/8 06	—	109	25	21	—

Eggs.

		Length mm.	Breadth mm.
June 2nd 1907. Stormkap. Fresh.	1.......	33	29
	2.......	34	25
	3.......	32	25
	4.......	34	25
June 18th 1907. The ship's-harbour. Fresh.	1.......	35	24
	2.......	34	25
	3.......	35	24
	4.......	35	25
June 21st 1907. Stormkap. Fresh.	1.......	35	25
	2.......	35	24
	3.......	34	25
	4.......	33	25
June 14th 1907. Hvalrosodden. Fresh.	1.......	35	23
	2.......	33	24
	3.......	34	23

Sanderling. *Calidris arenaria* L.

The Sanderling was decidedly one of the most frequently occurring birds in North-East Greenland — also nesting. I met with this species wherever suitable localities were to be found, as well far up the firths as on table-lands far from salt water. It occurred more rarely on the smaller isles, whether these were lying near the open sea or in bays and fjords.

The environments of the ship's-harbour, Stormkap and the plains N. and N. E. of Hvalrosodden were excellent nesting-localities for the Sanderling, which here occurred numerously; in August I sometimes met with flocks of enormous size.

The material collected and the observations made therefore mainly originate from these places, especially the Stormkap territory, where I had my permanent ornithological station in the summers 1907 and 1908. Unfortunately I am in want of positive information regarding the occurrence of this species in the northernmost part of North-East Greenland; the members of the northgoing sledge-party were not able to report anything, as most part of this journey was undertaken in a season, in which the Sanderling had not yet arrived in the country; besides the journey back to the ship was almost exclusively undertaken on the ice along the shore; here the waders would but exceptionally appear even if they had arrived to the country. The chief of the journey — Captain Koch — considers the explored stretches not to be suitable for the Sanderling; Amdrups Land on lat. 81° n. perhaps makes an exception to this.

It is not known whether Mylius-Erichsen and his two companions Hagen and Brønlund met with Sanderlings at Danmarks Fjord where they spent a summer. In Brønlund's posthumous diary, in which sparse notes regarding birds now and then can be found, the Sanderling is not mentioned.

The Sanderling arrived at Stormkap singly or in couples respectively June 2nd 1907 and May 28th 1908. In company with the other waders and large flocks of Snow-Buntings, which arrived at the same time, the Sanderlings would in the first days after their arrival resort to the few spots in the marshes and the surrounding stony plains, which were free from snow; here they led a miserable existence. Heavy snow storms and low temperature in connection with want of open water made the support of life difficult to the birds.

The temperature increased quickly and caused in a few days the places in which the birds could find food to extend very much. The areas free from snow grew larger and larger, and the ice along the beaches of small lakes and ponds with low water disappeared before the scorching sun; at the same time small ponds of melting snow were formed around in the field. Now the Sanderlings would in couples retire from the party of other birds, and lead a quiet and tranquil life on the stony and dry plains.

Now and then they would pay a visit to ponds of melting snow and beaches of fresh water lakes in order to bathe and seek food, and here they would join the party of other small waders as for instance *Tringa alpina* and *Ægialitis hiaticula*. According to my experience old birds would never resort to the salt water shore.

The pairing began towards the middle of June. The peculiar pairing flight of the male was to be seen and heard, when the

weather was fine and especially in the evening. Uttering a snarling or slight neighing sound he mounts to a height of some two meters from the surface of the ground on strongly vibrating wings, to continue at this height his flight for a short distance, most frequently in a straight line but sometimes in small circles.

When excited he frequently sits on the top of a solitary large stone, his dorsal feathers blown out, his tail spread and his wings half let down, producing his curious subdued pairing tones. He, however, soon returns to the female, which always keeps mute, and

Fig. 5. Typical Sanderling haunt. July 1908.

then he tries by slow affected, almost creeping movements to induce her to pairing, until at last the act of pairing takes place; when effected both birds rush away in rapid flight to return soon after to the nesting place. I have also observed males in pairing flight without being able to discover any female in the neighbourhood and then of course without realizing the pairing as completing act.

The male is in the pairing time very quarrelsome and does not permit any strange bird to intrude on the selected domain. He seems to be most envious against birds of his own kin.

While the Sanderling in the pairing time rather often and involuntarily evinces its presense, it is on account of its peculiar silent habits afterwards very difficult to observe.

Yet I succeeded by and by in meeting with the birds, the complete protective likeness and circumspect behaviour of which often surprised me, but only by the most careful examinations of such places, which I from experience judged to be suitable nesting-places. In the extensive moor- and marsh-stretches west of Stormkap are many smaller stony and clayey parts lying scattered like a sort of islands.

As these "stone-isles" are most restricted in size I could without special difficulty realize the existence of the birds here, and

Fig. 6. Typical Sanderlings Nest.

I found several nesting Sanderlings on such places. The problem was decidedly more difficult to me, when the birds had their homes on the extensive table-lands farther inland; here it will depend on luck to meet with a couple of nesting Sanderlings.

The laying began about June 20th. The first nest found containing eggs dates from June 28th; these had, however, already been brooded for some days. The clutch of eggs latest found dates from July 15th; the eggs in this nest were very much incubated. The Sanderling places its nest on the before mentioned dry clay-mixed stony plains sparsely covered with *Salix arctica, Dryas octopetala, Saxifraga oppositifolia* and a few other scattered low growths.

I only found the nest on places of this type, never on moors or plains entirely uncovered. The larger or smaller extent, the higher or lower position over the level of the sea and the distance from nearest shore of such locality is, according to my experience, of no consequence. It only seems, as if the Sanderling prefers to nest on such places, which are situated not very far from fresh water — a lake or a pond — to the shores of which the young ones are often directed. Some nests found prove however that the birds do not insist upon this.

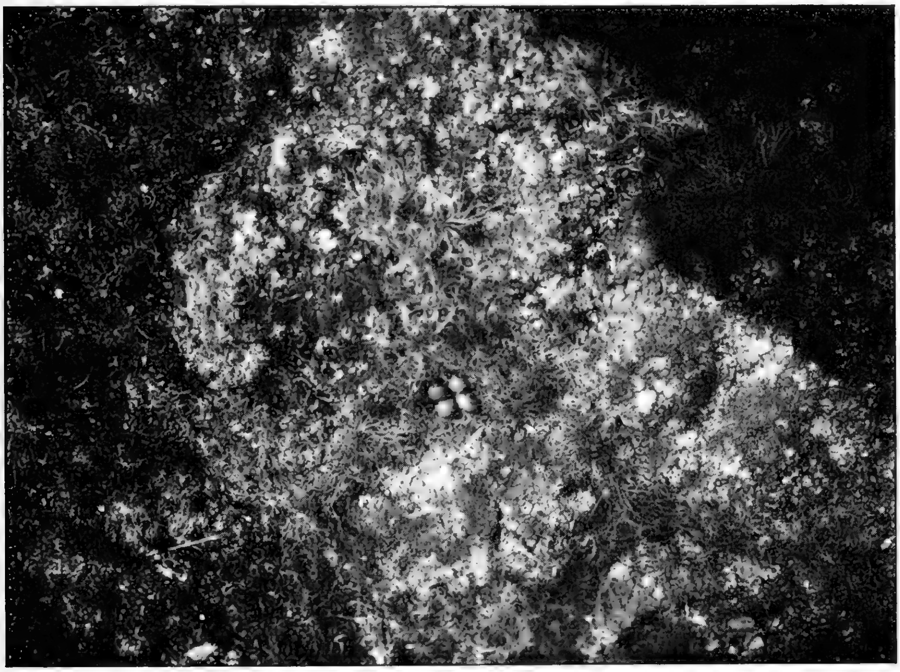

Fig. 7. Sanderlings Nest in unusual surroundings.

The situation of the nest is also extremely constant.

At the edge — or rarer farther in — of a tuft of *Dryas*, the bird will form a cup-shaped not very deep nest-hollow, the bottom of which is sparsely lined with withered leaves of *Salix arctica* or other plants growing in the neighbourhood. In size, and partly in shape the Sanderlings nest resembles that of *Tringa alpina*.

The striking likeness in colour to the surroundings and the monotonous character of the landscape makes it extremely difficult to find the nest unless the bird itself shows the way to it. The number of eggs in a clutch is always 4.

I found 11 nests with eggs and some 50 hatches of downy young ones but none of these differed from the normal number.

Till the laying is finished both birds will faithfully accompany each other, but as soon as the brooding begins, the males will join in smaller flocks and wander around on the table lands and at the beaches of the fresh waters, often in company with *Tringa canutus* and *Strepsilas interpres*. They usually left the country some days before the middle of July.

I secured several males for examination but never found the least sign of a breeding spot.

Old females can also be found in company with the males, though in far smaller numbers; as they have breeding spots, they may be birds disturbed in their breeding.

By excellent tactics the breeding female understands to keep secret the hiding-place of the nest. She will generally leave the nest so early and secretly, that even the most experienced and attentive eye does not percieve it.

She rushes rapidly from the nest with her head pressed down against her back executing some peculiar creeping movements quite mute, and hidden between stones and plants; following natural hollows in the ground she will first appear in a distance of at least 100 meters from the nest. By means of short, snarling and faint cries and now and then by flying up, she will then try to turn ones attention to herself.

She will often settle for some moments on small stones, clods of earth and similar places, from which she again will rush away with her dorsal feathers erected and her wings hanging down and always in a direction opposite to that, in which her nest is situated.

Yet I succeeded relatively easily in finding the nest, when through my field glass I followed the movements of the bird, lying in an ambush some hundred meters from the place, where I supposed the nest to be. During the day, and when the weather was fine, the bird would about half an hour continue to run and fly around, all the while snarling anxiously until she at last — when considering herself not to be watched — mute and in a zig-zag run hurries to her nest, on which she immediately lies down.

At night or in inclement weather the cold will make her disinclined to leave the nest for a longer while, and my observations and discoveries of nests could therefore most easily be undertaken in such cases.

Though more rarely, it would happen, that breeding birds instead of leaving the nest in good time were lying so close, that one could nearly catch them by hand. She would then keep herself quite motionless with her body pressed down in the nest and her neck and head stretched out; lying in this position she is ex-

tremely difficult to distinguish from the surroundings. The last mentioned behaviour is however by no means individual. I have several times observed the very same birds making use of both the plans.

My observations seem to prove, that the inclination of the bird to lie close on the nest increases as the incubation advances and in severe weather.

If the breeding bird is assured, that the nest is discovered, she will soon be confident, sometimes incredibly fearless; this I often observed when photographing the nests and the breeding birds.

After some 10 minutes the bird approaches the nest, and having for a while anxiously growling tripped around this, she will

Fig. 8. Sanderling on nest.

lie down on the eggs, which she thereafter immediately by some wriggling movements of the body will press against her breast. Within a distance of one meter I could then take as many photographs of the breeding bird as I wanted. The bird proved only a little nervous at the moment when the apparatus clicked, but generally she remained on the nest.

July 3rd 1907 I met on Stormkap with a breeding bird more than usually confident. Having for half an hour stayed by the nest on which the bird most of the time was lying quiet, and having taken not less than 5 photographs of her I removed the eggs, which had been brooded for some 10 days. Then the bird ran continually close to my feet, laid herself on the empty nest now and then, got up again and looked down into it; she plucked up the lining of her nest by aid of her bill in order to assure herself, that the eggs were really away. Several times again the bird laid herself on the

nest, and then she sought her eggs under plants and in hollows in the earth; at last she crept under the photographic apparatus, which I had left on the ground. When back again from this last reconnoitring, her hope was extinguished. With a short cry she mounted in the air and disappeared with a flight swift as lightning in a western direction. For an hour I awaited the return of the bird, but in vain.

The normal breeding position of the Sanderling is high; the body is only ligthly pressed against the eggs, the neck and head are rather erected.

The time of incubation is 23 to 24 times 24 hours.

The bursting of the egg-shells will generally begin already some 3 days before the emergence of the young. The mother-bird will immediately carefully carry the shells away from the nest in order not to attract the attention of Ravens and Skuas.

Between the emergence of the young will elapse not more than a few hours; as soon as the latest born young one feels sufficiently strong, that is when the down is dry, all the nestlings will leave the nest at the same time. If the old female considers the nearest surroundings of the nest to be unsafe or too difficient in food for the brood, she will immediately lead the young away. Thus I have met with newly hatched young ones, hardly one hour after their departure from the nest in a distance of 500 to 600 meters from this. In the cases concerned the disturbance by my frequent visits to the nests during the breeding may have caused the early departure.

The earliest date on which I found newly hatched Sanderling's chicks was July 11th, the latest August 2nd, but this must be considered abnormal.

In the following 12 to 14 days the chicks are guarded by their careful and extremely vigilant mother, who leads them over stony plains, by overflows of melted snow and fresh water beaches; they are eagerly occupied in seeking food, which at this period exclusively consists of small insects and larvæ and pupæ of these.

I have often observed, that the chicks take shelter under the wings of their mother from the cold nights and the heavy showers.

The chicks power of resistence against cold and severe weather is relatively small.

One night when the temperature was ÷ 1° I found at a beach of a little lake a brood of young ones some 2 to 3 days of age; they were with great care guarded by the old female. Having taken two of the chicks and placed them in my telescope-case, on the bottom of which I had at first spread some flakes of cotton, I went

on in order to bring the chicks on board alive; when I however after a quarter of an hour looked at them again, they were both lying dying in convulsions.

When the Sanderling wants to protect her young ones against hostile attacks, she executes still more surprising systematic tactics, than she does when brooding.

Already when at a distance of some 200 to 300 metres from the young ones, the old female would rush towards me and by all kinds of flapping and creeping movements in an opposite direction try to lead me astray; all the while she would now squeak like a young one and now growl angryly striving to draw my attention towards herself only. Now and then she would rise very high in the air in a direct rapid flight to disappear behind a rock on the opposite beach of a lake etc. From quite another direction she soon appeared again just before my feet.

If I finally retired still farther away from the young ones and for a while kept myself hidden in the field she would fly slowly some times quite low over the earth to the spot, where the young still were lying motionless and mute with their bodies pressed flat against the earth and their neck and head stretched out. When at last the female considers the danger to be over she, flying or running close to the chicks, produces a short chirping song at the tones of which all four young ones suddenly get up and begin to run about.

Only in this case the Sanderling produces its highly peculiar "Sanderling-song", which is very similar the song of *Sylvia curruca.*

As long as the young kept lying quiet on the ground in the before mentioned attitude they were extremely difficult to find, if I had not from my ambush by aid of my field-glass exactly marked down the spot, where they last appeared. The young ones do not seek any real cover as in hollows in the ground, under plants, behind stones or similar natural hiding-places.

When I had found a single young one, which while I kept it in my hands, began to chirp, it generally happened, that the three other young, which had till then kept quiet, suddenly rose and with the wings raised uttered a quite fine mouse-like squeaking and hastily rushed away, while the old female as if paralysed lay down before my feet still squeaking exactly like the chicks.

In cold nights and in severe weather the old female will on account of the susceptibility of her young ones only leave them for some moments; in such cases I therefore very quickly succeeded in finding the young.

By continually following the developement of certain broods

from the moment, in which they left the nest till they were able to fly, I succeeded in ascertaining several other facts concerning the biology of the young. I found no constant change in the places, where young ones of different age would go to live. Until they were quite able to fly, and then were left by their mother, they would resort to the before mentioned places by turns. I never saw young ones, which were still unable to fly, by the salt water shore or near this. In one case I met with a brood of Sanderlings on a spot different to the usual locality; this was a large sandy plain without any vegetation far from fresh water and more than 10 kilometer from the sea. The young were almost full-grown (August 8th) and must certainly have been hatched some two kilometer North of the place, where I found them; here I later on found a typical though small nesting-place.

Within 12 to 14 days the young ones are full-grown and able to fly.

Strange to say the brood of the Sanderling seems to suffer very little from hostile persecution, a fact, which may be due to the accomplished vigilance and prudent behaviour of the old female and the young as well as the extremely suitably coloured clothing of these. I wonder that these defenceless small beings can avoid the Polar Fox, which in this season more frequently than usual visits the domain of the waders, and which, as well-known, has an excellent sense of smell.

The fact that I, among the some 50 broods of downy young ones, did not find one defective may perhaps be taken as proof, that it is but a small part of its brood, that this species must yield to the not few bird-eating animals of the country. I admit, that the proof is not quite unassailable, when the question is about the Polar Fox, as this animal having found one young one will certainly be able to blot out every trace of the brood.

The Skua — *Lestris longicauda* — which occurs everywhere in North-East Greenland, is, as soon as it appears by the breeding-places of the Sanderling, pursued by these in the most violent manner.

I have in the country never seen Sanderlings nor other waders act on the offensive against Ravens, which however often visit the nesting-places of these.

The young Sanderlings are most subject to danger having joined in flocks on the shores of the firths before they have reached the full power of their wings. Here they only have to fear the Gyrfalcon.

I have not been able to point out any difference worth men-

tioning in the colour of the downy young of the same age; neither did I find any other difference. Though the young Sanderlings have now nearly reached the full size of their body and are able to begin to fly, their tails and wings have not by far reached their full developement and plenty of down may still be found on the head of the birds, on a border along the fore-breast, on the thigh on the under tail coverts and on the tail.

At this phase of development the flight is rather fast and easy, but not enduring. The young are still for a couple of days accompanied by their mother, after which this bird immediately leaves the country, and the young go just as quickly to the salt water shore. I have at this season never met with females, which did not accompany their young ones either singly or in flocks; this must prove, that they successively leave the country.

At the end of July the first young Sanderlings can be seen sociably running around seeking food. The birds still carry conspicuous remnants of their downy plumage, especially at the root of the bill on both sides of the crown, and on the thigh.

The young Sanderling, which when guided by its mother is so shy and timid, is suddenly transformed into the most confident and fearless little bird, the charming manners of which are still more pleasing than those of most other small waders.

The flocks of Sanderlings every day increase in size till they culminate about August 20th.

August 21st 1906 I met on the shore at Hvalrosodden with a flock numbering at least 300 Sanderlings. I walked there towards evening and, as the weather was unusually fine, the birds were very lively; the imposingly large flock of birds executed evolutions in the air with incredible dexterity, now scattered and then in a compact column, now very high in the air and then close to the glassy level of the sea. Having finished their flying manoeuvres the birds flew to the sandy shore of the firth, and here I could within quite a short distance observe the single birds.

The flock consisted exclusively of young birds many of them still wore remnants of the downy plumage around the root of the bill.

At low water crustaceans and worms were abundant on the shore; following a fixed system the Sanderlings with great perseverence picked these animals up. The searching began on a certain spot and was continued along the shore in such a manner, that the hindmost birds flew over the others and by this means became foremost. At high water the birds would scatter in small flocks along the shore or by the fresh water ponds lying near this. A few Turnstones and Ringed Plovers would mingle amongst the Sanderlings.

In 1906 the Sanderlings left in the first days of September.

A few laggards — late developed young ones — were observed September 9th; the preceding night the country had been covered with snow all over.

A young Sanderling, the upper bill of which was broken was found September 23rd near the ship's-harbour; it was frozen to death and extremely emaciated. I suppose, that the bird — like a few others — had flewn against the telephone-wire from the ship and thereby wounded its bill.

In August 1907 I setteled again by Hvalrosodden.

The Sanderlings seemed to appear in somewhat smaller numbers, than they did the preceding summer. I observed however every day scores of young birds along the shores of the firth.

As usual they were accompanied by a few young Turnstones and Ringed Plovers. A smaller flock of Sanderlings — 10 to 12 specimens — stayed close to my tent, which was standing near the shore. The birds devoured with great greediness the refuse of trout of which plenty were caught in Lakseelven. Especially the roe and the small crustaceans from the stomachs of the trouts were much appreciated by the birds.

A young Ringed Plover also appeared near the tent; it pursued the Sanderlings violently with the result, that it at last gained the monopoly of the refuse of trout. The Sanderlings only ventured to come near my tent again after I had shot the Plover.

It was evident, that the Sanderlings did not feel so well by the end of August when the cold of the nights increased and ice was formed along the shores. They stayed however near the tent for some further days and found here plenty of eating in the refuse of trout.

By sunset they retired for resting, and fell asleep while standing on one leg and their bill hidden deeply under their dorsal feathers; thus they spent the night until the reviving warmth of the morning sun allured them to new activity.

The birds became finally so confident of human intercourse, that they would hardly move, when I tried to drive them away to avoid treading on them.

The bay was covered by new ice August 29th and the Sanderlings — with exception of one — left the country the following day.

For the zoological museum in Copenhagen were collected the skins of 8 full-grown birds and 6 downy young and in spirit 20 full-grown birds and 14 downy young and 24 eggs (6 hatches). The following measurements have been taken:

Sex	Age	Date	Locality	Wing mm.	Bill mm.	Tarsus mm.	
♂	ad.	4/6 07	Stormkap	120	25	25	Skin.
♂	-	17/6 07	—	119	23	23	In spirit
♂	-	26/6 07	—	121	23·5	23·5	–
♀	-	19/8 06	—	123	23	26	–
♀	-	11/7 08	The ship's-harbour	124	28	28	–
♀	-	2/6 08	Stormkap	125	26	26	Skin.
♀	-	1/6 08	—	124	26·5	26	–
♀	-	26/6 07	—	124	25	25	–
?	juv.	7/8 07	Hvalrosodden	125	24	25	–
?	-	13/8 06	Koldewey Islands	124	24	25	–

Eggs.

		Length mm.	Breadth mm.
29/6 08. Stormkap.	1	34	25
	2	35	24·5
	3	35	24
	4	35	24
2/7 07. Stormkap.	1	38	25
	2	36·5	25·5
	3	36·5	26
	4	37	26
29/6 07. The ship's-harbour.	1	34	24·5
	2	36	24·5
	3	36	24
	4	36	25
7/7 08. Stormkap.	1	35·5	25
	2	34·5	25
	3	34	24·5
	4	35	24·5
3/7 08. Stormkap.	1	35	25
	2	37	25
	3	35	25
	4	35	25
29/6 08. Stormkap.	1	35·5	25·5
	2	36	25
	3	36	25
	4	36·5	25

Grey Phalarope. *Phalaropus fulicarius* L.

The Grey Phalarope occurred rather commonly in the moor at Stormkap and at the lakes and marsh at the ship's-harbour — also nesting. Only exceptionally it was seen elsewhere.

The north-going party of the expedition did not meet with it.

As this species in a higher degree than the other small waders requires open water it naturally arrived a little later in spring; in the two summers respectively June 13th and 9th.

Fig. 9. Grey Phalaropes.

Just after their arrival the Phalaropes were generally to be seen in couples near the spot, where they intended to nest but now and then some pairs would join for a little while and form a small flock. One day at the end of June I observed three couples in a little pond at Stormkap and in another pond five pairs. The little lively birds swam merrily around amongst each other zealously occupied in catching insects especially gnats. When disturbed by larger waders as for instance *Tringa canutus* or *Strepsilas interpres* or if they wanted to go to another place male and female always flew together.

At least 10 couples of Grey Phalaropes nested in the environments of Stormkap as well in 1907 as in 1908. The pairing began about a week after the arrival of the birds.

June 19th 1907 early in the morning I had the pleasure of watching for hours the actions of a loving couple of Phalaropes on the beach of a pool surrounded by large sedge-tufts, covered with long withered grass.

The beautiful birds behaved all the while so fearlessly that I could observe them from a distance of some two paces. At first they were entirely occupied in searching for food. Swimming on the water and going amongst the tufts they eagerly hunted for gnats and larvæ of these.

They caught the larvæ by swimming swiftly with the neck stretched out towards the selected prey. They would often keep the bill vertically and — reconnoitring the water just in front of them — pick up the prey, that was observed, with the greatest dexterity. Between the tufts the Phalaropes would especially hunt flying insects.

The birds would, as well walking as swimming execute nodding movements with the head just as *Fulica atra, Gallinula chloropus* and other marsh-birds. The two Phalaropes observed were evidently very much afraid of larger waders as for instance Knots. Several times I saw them rush together in terror and lie motionless on the water with their heads pressed down to their backs until the supposed danger — a passing Knot — was past; then they continued their meal or love-making.

This act I found very funny, peculiar and charming. When the male had been eagerly searching food for some 20 minutes, often standing on his head in the water like a duck to fish or pick up something from the bottom, he would lie down on a tuft stretching out his one leg and his one wing as if he would fully enjoy the rest after his exertions. The female for some moments was lying quietly and mutely in the middle of the pool; suddenly she began with increasing rapidity to whirl around on the surface of the water always in the same little circle, the diameter of which was some 10 cm.

As the male seemed to pay no attention to her alluring movements she flew rapidly up to him — producing as she left the water a peculiar whirling sound with her wings and uttering short angry cries — pushed him with her bill, and then she returned to the water and took up her swimming dance. Now the male came out to her and the two birds whirled around for some moments equally eager and with increasing rapidity. Uttering a short call the female again flew to a tuft surrounded by water and waited some seconds in vain for the male; again she flew to the water to induce him with eager pushes and thumps to accompany her. They again

whirled violently around, whereafter she, uttering a strong alluring sound flew back to the tuft this time accompanied by the male — and the pairing immediately took place.

In the matrimony of the Grey Phalarope the female only decides. She exceeds the male in size and brilliancy of plumage and has the decisive power in all family-affairs. If she wants to shift her place of residence she flies up swift as an arrow with a commanding cry — which may be expressed as "pittss" — and if the male does not follow her at once, she will immediately return and give him a severe punishment, which never fails to have the desired effect. It is a well-known fact, that she completely ignores her eggs and young ones.

It is peculiar, that the male has well marked breeding spots before the breeding begins and certainly before the female has laid her first egg; but this fact has been proved by several solid examinations.

June 26th 1907 I observed on the beach of the Bjergandesø in the Stormkap district, that the nest building was executed by the male. He was busy in building the nest on a low bank covered with short grass, while she paid no attention to his labour, but swam around the beach searching food.

The male shaped a nest-hollow by turning round his body against the ground on the place selected, having first by aid of the feet scraped away and trampeled down the longest and most troublesome straws. He diligently used feet and bill at the same time to arrange the shorter fine straws, which are carefully bent into the nest hollow and form the lining of this. The nest was much smaller than that of *Tringa alpina* and contained one egg the next day.

July 2nd I returned in order to see the nest and found it empty plundered by a Polar Fox, the traces of which could be seen around the nest and on the muddy beach of the lake.

Along the beaches of a smaller lake not far from the ship's-harbour I saw June 30th three solitary swimming males at least one of which showed signs of having a nest. I soon found this close to the place of residence of the male in question. The nest contained 4 fresh eggs and was built in exactly the same way as the before mentioned nest.

The male proved so far from being shy, that he could be driven to his nest and nearly be caught by hand; having laid himself upon the nest he was still more fearless.

A breeding Phalarope will lie motionless with his head pressed deep down against his back. He is almost fully covered by straws, which surround the nest, as he with the bill bends these over him-

self; besides he is so similar to the surroundings, that no human eye is able to distinguish him from these, if the spot is not known beforehand.

July 9th 1907 I again found a Phalarope's nest by the Bjergandesø; it contained 4 fresh eggs and was built a little differently from the two before mentioned nests. These were found close to a

Fig. 10. Grey Phalaropes nest.

lake on low banks covered with short grass, but this one was built on a tuft covered with long withered grass, situated some 10 metres from the real lake, but surrounded by shallow water, that came from a little river running out from the lake and irrigating all the tufts one of which contained the nest.

This bird also kept very close on the nest and did not leave it before I parted the long grass with my foot. When frightened up from the nest the bird for a short while lay screaming and flapping on the water not far from me; thereupon he flew away — silently

and rapidly — to land on the opposite side of the lake. Having been absent for some 5 minutes he returned just as rapidly, flew a good way to the other side of the nest sat down and kept quiet for a couple of minutes, whereafter he again flew up and took the earth some 20 meters from the nest, which he then rapidly approached walking and swimming hidden by aquatic plants and tufts. All this was done in order to mislead me, who was lying some 15 meters from the nest without any shelter and therefore seen by the bird all the while.

Fig. 11. Nesting locality of Grey Phalaropes. July 1907.

While photographing the nest and its surroundings I several times chased up the breeding bird, which every time repeated these manoeuvres always in exactly the same way. The female had already left the nesting place.

The Grey Phalarope in North-East Greenland — according to my experience — always nests on the mainland, sometimes a good way up the fjords but not on islands and skerries near the sea; on these the bird was never observed. In H. WINGE: "Grønlands Fugle" it is said, that the Grey Phalarope according to HOLBØLL only nests on the islands outside the shore.

The females depart immediately after their laying is finished. An accidental laggard was observed August 29th 1907 in the open

water off Kap Bismarck; this bird was — like every other female observed — in full summer plumage. I did not succeed in finding out the exact time of incubation and the time during which the male accompanies the young ones.

After the middle of July was passed I several times met with males with well marked breeding spots or rather with their breast and belly quite naked and with emaciated body. This fact certainly proves, that they had lately bred but had no nest to guard and no hatch of young to take care of, and might suggest, that these are left very early.

In the season in which the Phalarope could be supposed to guide his young ones — that is from the middle to the end of July — I zealously searched for it on spots, where this species used to nest, but never succeeded in meeting with any bird guiding young ones; this also confirms my supposition regarding the matter mentioned.

I never succeeded in finding young ones of the Grey Phalarope on account of their excellent faculties of avoiding the attention of human beings, especially in such difficult surroundings as these.

The males would — like the females — leave the country successively a short time after their duties to the brood were over.

As to its character the Phalarope is confident, lively and patient; its movements are very charming and its flight more rapid, than that of any other wader.

Its short pretty and penetrating call, which is uttered in flight especially is frequently repeated in thick fog and can be heard at a very long distance.

The Phalarope is, even in its breeding season when it continuously lives far from the sea, always seen on water or close to this.

The bird finds its food when swimming — as indicated before — most frequently along the shore of small fresh-water-ponds and lakes or between grassclad hillocks surrounded by quite low water.

Some twenty analyses of stomachs proved, that the Phalaropes in the breeding season chiefly feed on small insects principally gnats and larvæ of these. The æsophagus and stomachs of several birds killed were filled with larvæ of gnats, which in vast multitudes live in the fresh-water-ponds. In a few stomachs I also found fine indeterminable remnants of plants (Algæ?).

The females were at their arrival to the nesting places rather thin, while the males were extremely fat. During the long troublesome brooding, in which the male on account of the relatively low temperature only ventures to leave the nest for a few moments in order to search food, he will certainly make use of the stored-up fat.

The brood of the Phalarope must — like that of other small waders — especially be persecuted by Ravens, Skuas (*Lestris longicauda*) and Polar Foxes.

The only enemy of the full-grown birds is the Gyrfalcon (*Falco gyrfalco*), which will surprise and capture them when lying on the water.

This I succeeded in observing one day in summer 1907; just as I was observing a male Phalarope, which swam along the beach of a little clear pond hardly two paces from my feet, I suddenly heard a strong whistling in the air and saw an old falcon, that from a dizzy height shot like an arrow towards the surface of the water, caught the Phalarope and again rapidly rose in the air carrying the bird in its talons. I saw the bird of prey descend and settle on the summit of a rock near the bay in order to eat its prey. The method, with which the falcon carried out its exploit, proved that several Phalaropes before had the same fate. The Gyrfalcon can certainly not catch a Phalarope in flight.

The variations in colour of the female are but few and not very obvious. The dark throat-region was by single — I think rather old — birds nearly black, but in most individuals it had a greyish tone. The males vary a great deal in colour of breast and belly. Some of them had here an undiversified sorrel colour, other had more or fewer pale feathers and others again were nearly white. In one single male the throat was rather dark but not black. In the majority the dark part was strongly sprinkled with paler feathers. In a pair of males I only found a weak indication of throat-spot.

For the zoological museum in Copenhagen were collected 12 Grey Phalaropes and 4 eggs. The following measurements have been taken:

Sex	Age	Date	Locality	Wing mm.	Bill mm.	Tarsus mm.	
♂	ad.	24/6 07	Stormkap	125	22	21	Skin.
♂	-	16/6 07	—	129	21	23	—
♂	-	27/6 07	—	123	22	22	—
♂	-	23/6 07	—	129·5	23	24	—
♀	-	27/6 07	—	130	24	23	—
♀	-	17/6 07	—	130	23	22	—
♀	-	7/7 07	—	133	23	24	—
♀	-	15/6 07	—	131	24·5	24	—
♀	-	15/6 07	—	132	22	22	In spirit.
♀	-	17/6 07	—	131	22	23·5	—
♂	-	9/7 07	—	130	21	21	—
♂	-	13/7 08	The ship's-harbour	128	22	22	—

Eggs.

		Length mm.	Breadth mm.
June 30th 1907. The ship's-harbour. Not incubated.	1.	33	22
	2.	33	22
	3.	33	21
	4.	32	22

Iceland Gull. *Larus leucopterus* Faber.

The great likeness of this gull to the nearly related Glaucous Gull made it in many cases impossible for me to distinguish between the two species.

In those places inland where *L. glaucus* decidedly occurred most commonly I have but a few times seen Gulls which I could note down with certainty as *L. leucopterus.*

August 17th 1906 two Gulls appeared in the ship's-harbour and circled around the ship for some minutes.

As the birds were of comparatively small size and their wings were long I took them to be *L. leucopterus.* Both the Gulls were in full summer plumage.

A small Gull — an old bird in summer plumage — stayed in the days from September 25th to 30th of the same year in the ship's-harbour and around the Vestre Havnenæs lying near the harbour.

The Gull became gradually less shy as the bay became covered with new ice; at last it seemed to suffer much from cold and want of food. While it was lying on the ice forced up into the firth, I could — within a distance of a few meters — precisely observe every detail of the bird, the bill of which was more slender, than I have observed it in any Glaucous Gull. When the wings were kept close to the body, the reached a good deal over the tip of the tail, and the size of the bird was much smaller, than I ever saw it in a Glaucous Gull. Wounded by a shot the Gull disappeared towards the pack-ice.

June 20th 1907 I observed at Stormkap 5 old Gulls in full plumage migrating close over my tent; these birds also I put down as *L. leucopterus.*

I hardly believe, that any nesting-place exists on the tracts explored by the expedition. Immature birds were not observed here. During the navigation through the pack-ice on the voyage outwards

I often observed larger gulls as well older as younger birds, some of which may have been *L. leucopterus*.

August 8th 1906. Lat. 76° 10′ n. I saw a gull sitting on a snow drift close by the ship. Though I did not succeed in securing the bird, I have without hesitation noted it down as an Iceland Gull.

Glaucous Gull. *Larus glaucus* Brünn.

Though this species was in no place very numerous it occurred rather commonly nearly everywhere the expedition came.

It was, however, not recorded farther North than lat. 80° 20′ n. Here and a little farther South some 50 birds were counted June 9th and 10th 1907 by Koch and Bertelsen, who were of the opinion that the birds nested on the bird-cliffs lying in the neighbourhood.

During the navigation through the pack-ice — especially on the voyage outwards — Glaucous Gulls would often appear around the ship, sometimes singly and sometimes in smaller flocks.

The old birds would generally keep themselves separate from the younger grey coloured ones. The Gulls were usually shy and kept at a proper distance from the ship. They would often sit in small flocks on the tops of snow-drifts and ice-bergs.

A young male — presumably two years old — was shot at lat. 75° 52′ n. long. 16° w., August 11th [1].

This species appeared at the ship's harbour, Stormkap and Hvalrosodden in the end of May, while the bays and firths as well as the fresh waters were still covered with thick ice. The first two weeks after their arrival they were obliged to fly far and wide for food. In small flocks they used to fly so high in the air that I — only guided by their cries — could hardly discover them even by aid of my field-glass.

At flood time the gulls would diligently visit the cracks made by the tide along the shore; here they picked up small fishes — especially *Icelus hamatus* and *Gadus saida* — which were forced up to the surface. The gulls would surprisingly quickly discover shot seals and carcasses of other larger animals, upon which they fall with great greedines. By picking out the eyes of a carcass they would soon make their way to the brain, which seemed to be the most favoured part.

[1] Some of the big gulls observed in the pack-ice may have been *L. leucopterus*.

Several times I saw Glaucous Gulls — together with Ravens and Foxes — attend upon the meals of the Polar Bear.

Gradually as the sides of the lakes were thawed and the rivers began to run the Glaucous Gulls appeared here hunting the breed of trout (*Salmo alpinus*), which in most parts of such places occurred in great numbers. This hunting was also performed by the birds wading or swimming.

The pairing began in the first days of June. (June 2nd 1908 I observed a couple of *Larus glaucus* in the act of pairing on a skerry in Stormbugt.)

The gulls nested in smaller parties on the steep rocky walls by Sælsøen and certainly also by Teufelkap and Koldewey Islands. As the nests were placed on such inaccessible rocks I did not succeed in examining them more closely.

Mr. Freuchen found two hard incubated eggs on a large stone lying solitary, to all sides surrounded by water July 7th 1908. The eggs were brought home.

This certainly uncommon place for a nest may have been chosen on account of its excellent situation for fishing.

The grown up young ones left the nesting colonies about the end of August and resorted to the shore, where they for some days further were fed by their parents.

At my stay at Hvalrosodden in the last half of August 1906 I daily had good opportunity to study the behaviour of the Glaucous Gulls.

Some 100 gulls among which were some younger birds had settled on the bars of sand not far from the mouth of Lakseelven. At certain times of the day the Gulls used to undertake excursions up the river and along the sides of the lake.

Sometimes they would fly over the bay or along the shore to the very bottom of Mørkefjord. They especially hunted trout, which in the fresh waters and in the bay occurred in vast multitudes. Especially early in the morning they were busy hunting trout.

I found trout measuring as much as 38 cm. in the œsophagus and stomachs of shot gulls.

The gulls used at ebb-tide to gather the larger and smaller crustaceans which were left on the shore. A zealous chase after the young ones of the Long-tailed-Duck was sometimes undertaken.

Some carcasses of walrusses lying on Hvalrosodden were, strange to say, not very attractive to the gulls, which only now and then would take a bite of the half rotten blubber. At our tents they proved very forward and would busily pick up the thrown out entrails of hares and salmons.

Towards evening the Gulls would assemble at their roosting place uttering a violent screaming and barking. At sunset they undertook from here — in one flock — a detour of short duration to the rocks on the West probably the nesting-places; from here they returned to the sandbars, on which they spent the night.

The young ones would at the end of August gradually go to sea where they immediately mingled with the old gulls on the bar without however following these on their more extensive excursions.

As mentioned before they were still fed by the parents for a while. The majority of gulls disappeared from the country at the beginning of September.

August 1907 I visited Hvalrosodden again and found some Glaucous Gulls, but by far not so many as the preceding year. But very few young ones had been hatched, and I did not see one bird of the age of 1 to 2 years. The unfavourable ice conditions probably account for this reduction.

In the summer 1908 the Glaucous Gulls appeared again in normal numbers.

For the zoological museum in Copenhagen were collected the skins of 4 old and 1 young bird and the beforenamed two eggs. The following measurements have been taken:

Sex	Age	Date	Locality	Wing mm.	Bill[1] mm.	Tarsus mm.
♀?	ad.	23/8 06	Hvalrosodden	475	70	70
♂	-	21/8 06	—	500	75	75
♂	-	22/8 06	—	490	70	70
♂	-	2/6 07	Stormbugt	490	70	70
♂	juv.	29/8 06	The ship's-harbour	450	58	70

Eggs.

			Length mm.	Breadth mm.
7/7 08.	Sælsøen.	1.......	75	56
		2.......	73	55

Kittiwake. *Larus tridactylus* L.

In the country itself the Kittiwake was only observed at Mallemukfjeldet and some other smaller bird cliffs lying near to this between lat. 80° 10′ and 80° 20′ n. KOCH and BERTELSEN counted

[1] The bill measured with a measuring tape from the base to the tip.

here some 100 individuals June 9th & 10th 1907. It is however probable, that a greater number were nesting on these places.

During the navigation from the Shetland Islands up to the pack-ice a greater or smaller number of Kittiwakes appeared nearly every day around the ship; but as we forced our way through the ice I only now and then observed this species, generally solitary birds near the edge of the ice.

Yet I recorded 9 old birds sitting on a hummock of ice together with some *Sterna macrura* and a larger Skua farther in the pack-ice at lat. 75° 20′ n. long. 8° w. August 1st 1906.

Strange to say, the Kittiwake appeared but sparsely amongst the vast multitudes of sea-birds, which were seen off Jan Mayen.

Ivory-Gull. *Larus eburneus* Phipps.

The Ivory-Gull appeared in great numbers only on one place but proved however rather common as well in the pack-ice as on the isles and outer-skerries lying near it.

Some few Ivory-Gulls would as an exception pay short visits to the bays and firths.

This species was not observed more northerly than lat. 81° n.

Though but one smaller nesting-colony was found it cannot be doubted, that the Ivory-Gull nests comparatively commonly on the outmost lying islands and skerries in the tract from Kap Marie Valdemar to Mallemukfjeldet; here several old and young birds were recorded in the breeding-season at several places.

August 15th 1906 I landed for a short while at Kap Marie Valdemar and observed here several old Ivory-Gulls on some islets near the pack-ice. The behaviour of the Gulls made me suppose, that their young ones were on the island. My stay here was very short and the means of conveyance extremely difficult, therefore a nearer examination was unfortunately impossible.

Dr. Lindhard, who was left at Kap Marie Valdemar together with 5 other members of the expedition, lived here and on the mainland and the isles North of this point from August 16th to 26th. He reports to have seen many Ivory-Gulls — as well old as quite young birds — especially at Kap Marie Valdemar.

Regarding the occurrence of this species higher North along the shore, I have received the following notes from Koch and Bertelsen.

June 5th 1907. Lat. 81° n. 12 Ivory-Gulls flocked near the tent, before which a killed seal was lying. One Gull was shot and eaten by the sledge-dogs. All the gulls observed were quite white and proved not to be shy. Open water was near.

June 6th 1907. Lat. 80° 57′ n. Ivory-Gulls in abundance by a seal killed by a bear. By the carcass of a shot seal and by that of a walrus were also many Gulls.

June 9th to 10th 1907. Lat. 80° 20′ to 80° 10′ n. Some 50 Ivory-Gulls observed at the bird cliffs.

Fig. 12. Where the Ivory-Gulls nests were found.

June 11th 1907. Lat. ca. 80° n. 2 Ivory-Gulls observed.

June 12th 1907. Lat. 79° 40′ n. 4 Ivory-Gulls.

The Eskimo Tobias Gabrielsen visited Renskæret June 28th 1908 though the travelling was very difficult; at the eastern coast he found 3 nests of Ivory-Gulls, one of them contained two little incubated eggs, the others each one fresh egg. One of the eggs from the clutch first mentioned was broken on the way back to the ship. At the nests 7 Gulls were observed; three of them were secured and came into my possession.

They proved to be old, quite white birds; the one — a female — had a breeding-spot.

The next days the ice conditions became much worse and consequently I could not force my way to the nesting place, but was obliged to wait for open water; consequently I did not succeed in examining the nests of the Ivory-Gulls before July 18th.

At the spot indicated by the Greenlander I found within an area of 50 □ meters 7 empty, newbuilt nests, all of them, however, showed signs of having contained eggs. I feel sure, that these had been removed by the crews of some Norvegian whaling vessels that July 10th visited Renskæret and the surrounding isles for the pur-

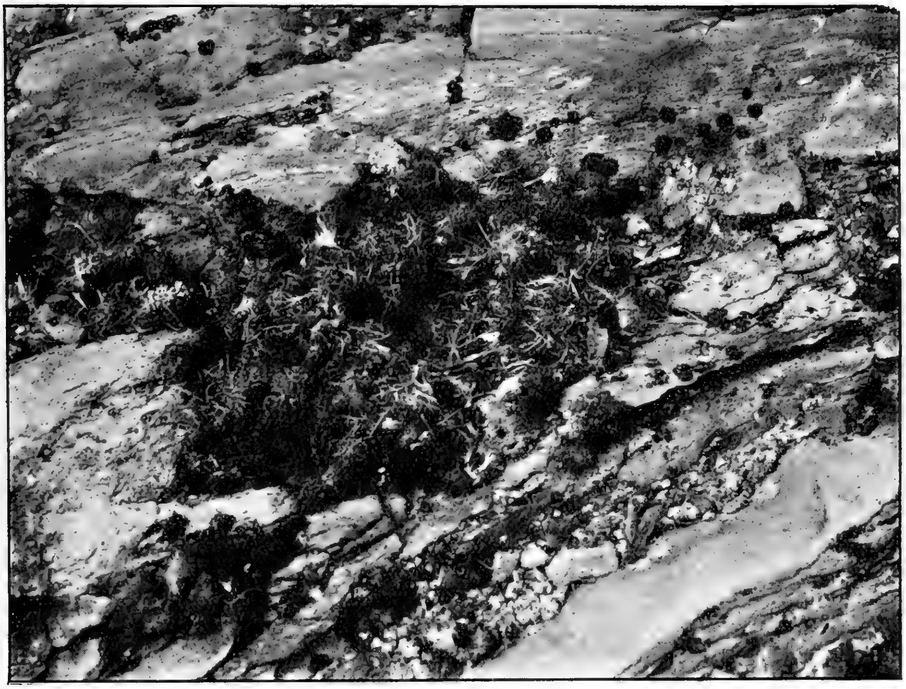

Fig. 13. Nest of Ivory-Gull.

pose — as the master told me — of collecting eggs. When the Eskimo visited the breeding-colony June 28th this consisted of but 3 nests; the other 4 must then have been built in the time from June 28th to July 10th. (The day at which the plundering took place.)

The nests were situated at the east-side of the island on a range of cliff very near the field-ice elevated some two meters over the level of the sea, quite level at the top and barren. The nests were of quite the same exterior and built of the same materials. The hollows of the nests, the diameter of which measured 16 cm., were lined with soft moss and a few thin straws, and were surrounded

by a 25 cm. broad ring, carefully made of rather large compact pieces of moss kept together by a few long straws. As the environs of the nests were absolutely without any vegetation, the Gulls must have fetched the materials from another place on the island, where this species of moss grows very luxuriantly. In the nests were found a few feathers lost by the breeding birds. They were — except two which were lying close to each other — evenly distributed over the area mentioned.

No Ivory-Gull appeared either this time or during my visit to the island four days later.

Like other swimmers this species did not nest on Renskæret in the summer of 1907. This fact was due to the unfavourable ice conditions.

During the navigation through the pack-ice — as well on the voyage outwards as homewards — I almost every day observed some Ivory-Gulls; they used to pass the ship solitary or in small flocks containing 3 to 4 birds. Like the Glaucous Gulls they would often settle on the hummocks of ice.

Though the Ivory Gulls cannot be said to be shy, they were in the ice rather cautious and not so forward by far as were the Fulmars. While these would exhibit great fearlessness and snatch pieces of blubber thrown out, the Ivory-Gulls would always keep at a distance and not strike for the morcels before the ship was a little way off; they would only overcome their fear if one of their companions was shot, from a far circumference they would then assemble around their killed companion even if exposed to a violent gun fire.

When the ship was stopped by the pack-ice and obliged to keep quiet surrounded by interminable flakes of ice the Ivory-Gulls — besides a solitary Fulmar — were the only birds that visited us. This pretty bird with its short but sonorous note would make a wonderfully animating impression in these silent and desolate surroundings. Outside the border of the ice this species was not recorded farther South than lat. 74° 30′ n. long. 3° 15′ w. The majority of the Ivory-Gulls observed in the ice were immature birds in moult. Round the base of the bill the feathers were dirty-grey and the edge of the wings was dark. Yet a couple of pure white old birds was shot here. In the stomachs examined I usually found a few thin bones of fishes and remains of crustaceans.

One stomach contained remains of a seal certainly *Phoca foetida*; in another — belonging to a bird killed July 30th 1908 in the pack-ice lat. 75° n. long. 9° 40′ w. — was found larvæ of *Chironomidæ*, mandibles of an insect larva and some particles of Chitin. This stomach also contained a great quantity of parasitic worms.

For the zoological museum in Copenhagen were collected 6 skins of Ivory-Gulls and the before mentioned 3 eggs from Renskæret which vary very little.

The following measurements have been taken:

Sex	Age	Date	Locality		Wing mm.	Bill mm.	Tarsus mm.
♀	ad.	2/8 06	The pack-ice.	Lat. 75°40′ n. long. 10° w.	323	36	32·5
♀	jun.	8/8 06	—	Lat. 76°10′ n. long. 15° w.	In moult	36	36
♂	juv.	8/8 06	—	—	—	41	38
♂	-	2/8 06	—	Lat. 75°40′ n. long. 10° w.	330	38	38
♂	-	4/8 06	—	Lat. 75°50′ n. long. 11°10′ w.	In moult	38	35
♂	-	2/8 06	—	Lat. 75°40′ n. long. 10° w.	—	38	36

Eggs.

		Length mm.	Breadth mm.
June 28th 1908. Renskæret.	1 fresh egg in the nest . .	59	42
	1 — . .	60	43
	2 slightly incubated eggs one of them broken . .	61	43

Sabine's Gull. *Larus sabini* Sab.

Although I was always on the lookout for Sabine's Gull whereever suitable localities for this species — islets and skerries near the field-ice — were at hand, it was only a few days before the departure of the expedition, that I had the good luck to meet with this species even breeding.

The further particulars regarding this interesting event are given thus in my diary: July 18th 1908. This noon Gundahl-Knudsen and I landed on Renskæret in a very dense fog in order to photograph the nests of Ivory-Gulls at the south-eastern part of the island; we were immediately received by a swarm of Arctic Terns (*Sterna macrura*), which nest on the island in vast numbers. Among the highest flying Terns I soon observed a Sabine's Gull, which passed over my head without moving its wings and then disappeared in the fog in a northern direction. I stopped for some moments awaiting the return of this rare gull, but in vain; it seemed to have completely disappeared. The fog increased and it proved impossible to use a field-glass. Then I went, constantly surrounded by screaming terns, to the nests of the Ivory-Gulls; I photographed these and walked towards the northern end of the island hoping to see the Sabine's Gull again; the fog was now clearing. I was very much

pleased when it appeared again still cautiously sailing very high in the air and far out of gunshot range. Now and then it would disappear among the swarming terns. On my arrival at the most northerly point of the island suddenly 3 Sabine's Gulls appeared; one of them immediately left the island and flew to an ice-berg lying some 200 meters from it. The gulls were still shy and cautious, but their behaviour proved, that they were nesting on this part of the island. The gull on the ice-herg soon left this and joined its two companions; then all three gulls went on with their circling very high in the air while the swarming terns filled up its lower regions. As my stay on the island neccesarily had to be of short duration — not exceeding a couple of hours — I resolved to secure one of the birds if possible.

Having waited a short while I actually succeeded.

The bird killed was a male with well marked breeding spots, and having observed this I felt sure, that eggs or small young ones could be found on the island and probably near the spot on which I was standing. The fog had now cleared fully, and I was able to use my field-glass. My companion and I retired to some low rocks, lying some 200 meters from the spot, where I supposed the nests to be. From my ambush I was able to study the behaviour of the gulls through my field-glass. While the terns one by one would soon go to their nests, which contained hard incubated eggs or downy young ones, the two Sabine's Gulls kept circling for a long while high in the air often attacked and pursued by the terns. After half an hour the gulls seemed inclined to come down, but still they kept flying cautiously around quite low for a while; until finally one of them rushed down on its nest. I marked the spot exactly and ran towards it. The gull flew off the nest as soon as I appeared uttering some feeble husky cries or grunts, whereafter both birds mounted to a great height again.

I immediately found the nest, which contained two much incubated eggs. Five meters from this nest I found another exactly of the same type.

Though empty it showed signs of having been in use not long ago. Our zealous search for young ones was in vain. Some Norwegian sealers had a week before visited Renskæret for the purpose of collecting eggs; they had certainly plundered the 7 nests of the Ivory-Gulls and perhaps they may also have removed the eggs from the one nest of Sabine's Gull. The two gulls were still extremely shy; and it took an hour before I succeeded in securing them. They were male and female and both of them had well-marked breeding spots.

I photographed the nest with eggs before we left the island. Nests of terns in abundance were found around and close to the nests of Sabine's Gulls. These are very like those of the Arctic Tern, but a little larger and lined with a few withered twigs of *Salix arctica* and big pieces of straw. On the whole they are more carefully formed than the nests of Arctic Terns, which in these regions are almost always without any nesting materials.

Not far from the two nests of Sabine's Gull I finally found one more, which I supposed to be an old nest of the same species. Sabine's Gull has probably nested here in former years.

Fig. 14. Nest of Sabine's Gull.

In the summer of 1907 I several times visited Renskæret and stayed here and on the near lying little island Maroussia from July 13th to 17th. Neither Arctic Terns nor Ivory-Gulls nested here in that summer on account of the unfavorable ice conditions, which would probably also have prevented Sabine's Gull from nesting; this undoubtedly accounts for the fact, that neither Ivory-Gulls nor Sabine's Gulls were recorded in 1907.

Renskæret is a little island of elongated form, stony and sprinkled with low rocks; its eastern coast is facing the pack-ice. The vegetation is in most places exceedingly poor. The northern part of the island, on which Sabine's Gull nested is covered with barren

gravel and is nearly flat. The nests were lying some 25 meters from the sea.

It is difficult to distinguish a flying Sabine's Gull from an Arctic Tern on places, where the last is predominent in numbers. The best distinctive mark is the black primaries of the gull; these can in some cases plainly be seen.

There is no great difference between the size of the two birds and the different colour of the head is not very conspicuous. On dissection of the killed Sabine's Gulls I found in the stomach of one of them a few small jaws of cuttle-fish; the two other stomachs were empty. As it seemed strange to me, that three nesting Sabine's Gulls appeared and not an even number, I visited Renskæret again July 22[th] at the departure of the expedition from Danmarks Havn, in order to see the fourth gull if possible. This time I stayed on the island for more than 4 hours but did not see any Sabine's Gull, and I feel sure, that there were none.

The Norwegians may perhaps have shot the fourth gull.

On the three skins and two eggs, which were handed over to the zoological museum in Copenhagen the following measurements have been taken:

Sex	Age	Wing from wrist to tip mm.	Bill mm.	Tarsus mm.	
♀	ad.	282	26	31	Hind toe small but well shaped.
♂	-	292	27	32	—
♂	-	283	26	33	—

Eggs.

	Length mm.	Breadth mm.
1.......	46	32
2.......	45·5	32

Arctic Tern. *Sterna macrura* Naumann.

The Arctic Tern breeds in great numbers on all smaller islands and skerries as well near the field-ice as in the bays and firths.

Only exceptionally I met with smaller nesting colonies on the mainland. (Islets in fresh-water-lakes and projecting points.)

Koch and Bertelsen observed this species farthest North in the open water by Mallemukfjeldet. (June 9[th] 1907; lat. 80° 20′ n.)

[1] Renskæret is 850 meters long; its greatest breadth is 380 meters. The distance from Maroussia is 1880 meters, from Maatten 1120 meters and from Kap Bismarck 1780 meters.

The ship often passed smaller flocks of Terns during its navigation through the field-ice. I observed for instance 7 Arctic Terns sitting on the top of an ice-berg in company with some *Larus tridactylus* and a solitary Skua at lat. 75° 20′ n. long. 8° w. August 1st 1906.

In the two summers the first Terns arrived in the neighbourhood of Danmarks Havn respectively June 14th and June 16th.

That Terns were observed June the 9th 3 degrees farther North was due to the fact, that the ice conditions of this place were highly favourable. (Similar observations regarding other sea-birds have also been made.)

Fig. 15. Arctic Tern on nest.

The Terns would take to their nesting-places immediately after their arrival.

The laying began the last days of June. The nests are placed in very various situations: in grass, between small stones and on naked cliffs.

The number of eggs in a clutch was usually two; I found, however, also Terns breeding on one or three eggs.

The eggs vary extremely as to colour, size and shape.

At the nest the birds proved very bold striking at and hitting my head with their beaks when I approached the nest. Ravens, that visited the colony were attacked and pursued in the most violent manner by the furious Tern-flocks.

About July 20th the young ones emerged. They were fed by the parents even after they were able to fly; they received the food

sitting around on hummocks of ice or rocks. Snow-showers and low temperature did not seem to trouble the full-grown young.

At the end of August the Terns departed.

The Terns, like certain other species, did not nest in the summer of 1907. This year I stayed on the little island Maroussia from July 13th to 17th in order to study Terns and Eiders, which usually nest on the island. The ice was lying all over, meters in depth, with a few cracks, caused by the tide, and many ponds of melted snow. Terns appeared every day on the island 4 or 5 times; they circled screaming over it for a while and then set off again always in a westerly direction. On killed birds I found no indication of a breeding spot nor any other sign indicating, that they intended to nest. I found on the island a single fresh laid egg; but it was infertile and carelessly dropped. Similar observations regarding Terns were made a couple of days later on the skerries in the Stormbugt. Also here I found single dropped eggs lying around.

The Terns occurred not seldom inland by the fresh waters, especially by lakes with plenty of young trout, which the Terns like very much; but far more often they could be met with at the mouths of rivers and broad cracks in the ice near the coast. The food, which they sought here, was certainly exclusively small crustaceans.

For the zoological museum in Copenhagen were collected the skins of 4 full-grown birds and two young ones in spirit and 13 eggs. The following measurements have been taken.

Sex	Age	Date	Locality	Wing mm.	Bill mm.	Tarsus mm.
♂	ad.	15/7 07	Maroussia	265	32	15
♂	-	15/8 06	N. Lat. 77°20'	278	31	16
♀	-	15/7 07	Maroussia	270	32	16
♀	-	15/8 06	N. Lat. 77°20'	281	34	16

Eggs

			Length mm.	Breadth mm.
July 6th 08	Maroussia. Slightly incubated.	1	36	28
— 3rd 08	Terneskær. Fresh laid	1	37	30
		2	35	29
— 3rd 08	Maroussia. Fresh laid	1	43	30
		2	40	30
— 6th 08	Maroussia	1	42	29
		2	43	29
— 3rd 08	Terneskær. Slightly incubated	1	40	29
		2	42	29
— 1st 08	Maroussia. Two normal eggs and one dwarf-egg in the nest. Not incubated	1	22	18
		2	40	30
		3	38	29

Buffons Skua. *Lestris longicauda* (Viell.).

Extremely common breeding-bird on the mainland and the larger islands. I met with breeding Skuas in the most desolate places far from the open sea at the very head of the longest fjords. On the smaller islets however I did not find it. I got but scanty information concerning the occurrence of this species farther north. Koch and Bertelsen did not meet with it farther North than N. Lat. 80°57′ (June the 6th 1907).

In Brønlund's posthumous diary the Skua is not recorded and I therefore feel sure that it does not breed in the "Danmark's Fjord" region.

During the navigation through the pack-ice this Skua was frequently seen, generally immature birds.

As there was a marked difference in the breeding habits of this species in the three summers of our stay, I shall give extracts of my notes for the three years.

On the arrival of the expedition in the middle of August 1906 I found the species abundant nearly everywhere. Numerous breeding couples were seen, for instance on Koldewey-Islands at Kap Marie Valdemar, the ship's-harbour, Hvalrosodden and Stormkap.

The Stormkap district was the most thickly populated locality, and here I counted some 30—40 couples evenly distributed all over the place. The fledglings were sitting round about on blocks of stone and clods, still carefully guarded and fed by the parents. One late hatched chick, scarcely a week old, was seen on August 17th on a little bog not far from the ship's-harbour.

A great number of stomach analyses showed, that both the young ones and the old birds fed on Lemmings, which this summer occurred in vast multitudes. The extreme fatness of the young ones gave evidence of the great "embarras de richesse".

I was therefore surprised to find, that all the couples, with but one exception, had only one young one, though the rule as far as I know should be two.

Besides the breeding birds and the birds of the year I daily noticed smaller parties of individuals 1 and 2 years old, hunting Lemmings.

While the old birds would stick very devotedly to their breeding quarters inland, where they, as before said, hunted Lemmings and nothing else, the immature non-breeding birds could be met with both out at sea and along the coast line.

At the end of August the parents ceased to feed the young, and all the Skuas in the country departed immediately after. I saw

them fly away in smaller flocks, not containing more than 15—20 birds; as far as I could see the old and young birds went together.

In the summer 1907 the first Skua arrived at Stormkap on June 5th; at the same time the bird was observed at the ship's-harbour and at Hvalrosodden.

In the following days I witnessed a migration of breeding birds, which in my opinion took place in quite the normal way.

The Skuas arrived in couples and immediately took posession of their nesting-places, each couple guarding its district with the same zeal as they did the preceding summer.

Everything looked normal, and my fears, that the great reduction in the number of Lemmings caused by the severe winter, might cause disturbance, seemed needless.

However, the Skuas soon after their arrival appeared very disappointed; the first days they were as usual sitting upon large stones and other prominent points lurking for Lemmings whose numerous well-known holes the experienced birds watched in the same way as the summer before; but they soon gave up this sport, and I afterwards saw them running amongst the knolls catching butterflies and other insects.

At the end of June the Skuas were seen in flocks flying over marsh and plain only to disappear altogether from the country a few days later.

Not one breeding Skua-couple was to be seen anywhere either at Stormkap or at the other well-known breeding places.

July the 17th I met with a couple of old Skuas at an open crack in the field-ice not far from Renskæret; the birds were accidental stragglers and were snatching dead or dying small fishes (*Cyclopterus spinosus* and *Liparis fabricii*) which were forced up to the surface by the current. I did not see one immature bird this summer.

In the stomachs of the Skuas shot this summer I found mainly remains of insects occasionally also leaves of *Salix arctica* and other remains of plants, but in no case *Myodes torqvatus*.

In 1908 the Skuas appeared a little earlier than the summer before; the first couple was seen May 28th. The Skuas seemed to suffer more from the first days inclement weather, the snow-showers and the low temperature at night, than did the small waders arriving at the sometime. I often saw them lying on the large stones in the moor at Stormkap exhausted by hunger and cold. Until the country was free from snow the Skuas frequently visited the shore and the ice in its neighbourhood; I think they got now and then an opportunity to catch fishes in the rarely occurring cracks in the ice. Only adult birds were however to be seen.

During the beginning of June the Skuas distributed themselves over their old nesting-places and they fed again essentially on Lemmings, which certainly were not nearly so common as in the autumn of 1906 appearing however so frequently upon the whole of the territory, that the Skuas did not hesitate to breed. The laying took place at the end of June (the first nest containing a fresh-laid egg dates from June 18th) and in the next days very many Skuas-nests were found everywhere in the Stormkap territorry, at Hvalrosodden and in the neighbourhood of the ship's-harbour.

In other words this summer the breeding-conditions were quite normal. Later in the summer numerous immature birds appeared just as in 1906; their behaviour corresponded exactly with what I had noticed earlier.

This Skua prefers as breeding-ground stony, sparsely covered plains. But here the birds absolutely require a small bog, a fresh-water pond or an overflow of melted snow near the nest.

The distance from the nearest salt-water may differ a good deal; nests were found 30 km. from the shore.

The nest is a shallow hollow in the ground, natural or scraped by the bird, and sparsely lined with some few withered straws and a single leaf or two of *Salix arctica.*

Mr. HERLUF WINGE in his "Grønlands Fugle" page 210 says regarding this species that "it breeds socially and is according to HOLBØLL nearly always seen in flocks".

In N. E. Greenland quite the reverse is the case.

In 1908 some 40 Skua-couples nested in the Stormkap region, where so many Lemmings lived. The nests were evenly distributed all over the territory, so that every couple became posessor of a certain hunting-district the outlines of which were drawn with a certain — almost geometrical — accuracy; inside these limits no stranger would be tolerated.

Similar conditions, though not quite so conspicuous, were found on all other places where I had the opportunity of watching nesting Skuas.

The majority of the Skuas-nests found in 1908 contained two eggs.

Between the laying of the 1st and 2nd eggs as much as 50 hours may elapse; the rule however is 36 to 48 hours. Later on I observed, that the young ones emerged with a corresponding difference in time.

The normal time of incubation is 23 days.

The eggs are extremely variable in shape, size and colour. Several types were, with respect to the structure and colour of the shell as well as to the shape and size of the eggs, so similar to

certain types of *Larus ridibundus*-eggs, that I could not find any difference by later comparison.

As far as I could notice the sexes divided the breeding duties evenly between themselves.

The positure of the bird while breeding is high the neck and head erected.

While the one bird broods, the other guards its mate and the hunting-territory.

As soon as a bird of the same species or another larger bird appears upon the scene, the watching bird utters a long penetrating

Fig. 16. Buffons Skua on nest.

cry and attacks the unwellcome guest; having chased him off, the Skua again takes its seat near the brooding mate.

If you approach the nest both Skuas will fly towards you and almost strike your head with their wings, all the while uttering their short "krryw" "krryw". The nearer you come to the nest the more anxious and offensive are the Skuas.

If you retire some 50 meter, the bird will quickly settle upon the nest again.

The clamourousness and fearlessness of the bird make it easy to discover nearly every nest even on a most extensive territory.

If the eggs be removed from the nest, the Skua will nevertheless as a rule lie down upon the nest for some few minutes. In a certain case I saw a bird lying more than half an hour upon the empty nest.

The chicks, which soon after the hatching leave the nest, seem during the first days to be principally fed with insects — in the gullet of a newly hatched bird I found a crane-fly (*Tipula*) — but they are even when quite young able to eat lemmings, which the parents hunt, eat and afterwards disgorge before them.

The young ones grow very quickly.

It is a well-known fact, that the young of this Skua appear before the first moult in two colour varieties: a pale and a dark. The pale variety seems to occur somewhat more frequently than the dark.

The difference in colour can be seen already on the downy young.

Though the two varieties may approach very near to each other, I never found quite intermediate specimens. Both types may be found in one clutch.

Fig. 17. Buffon's Skua near the tent.

By the grown up young ones the difference in colour will especially be promiment on the head, hind neck and the fore-part of the back. Except in colour no external difference was to be seen in the youngs.

The peculiar unsociability of this Skua in the breeding season, which causes the couples to live so scattered as mentioned before, the striking appearance and size of the bird together with its penetrating voice make a singular effect upon the observer, and more than any other animal this bird gives character to the fauna of these lonely regions. In summer it puts in an appearance everywhere.

Now it will be resting immovable upon its stone lurking and spying, and then it will upon rapidly flapping wings watch over a newly scraped lemming hole. In one moment it laments with short anxious cries at the nest and a moment after it assails

with a lengthy fierce war-whoop an intruding neighbour in rapid flight.

The smaller birds hate the Skua, which is an expert egg-thief. Especially the Turnstone is indefatigable in its pursuit of the detested enemy.

The Skua itself seems to fear but few enemies; though the Polar Fox certainly values the Skuas eggs and young ones, and the Gyrfalcon undoubtedly likes to feast upon the latter, the enraged Skua-couple are as a rule able to scare them both off.

The adult birds may be told by their two fully grown elongated central tail feathers, which are of equal length, by the unmixed

Fig. 18. Buffon's Skuas.

slate grey colour of the back, by the black head and the unspotted white fore breast.

No external difference between the sexes is noticeable. Birds in full plumage vary a good deal with regard to the yellow colour of the neck, which may be more or less intense, and furthermore the extent of the slate-grey part of the abdomen may vary a good deal.

The plumage of those immature birds, which in 1906 and 1908 were observed, varied extremely. While some of them still wore many remnants of the plumage of the young and but slightly elongated central tail feathers, some individuals — most likely two years old — came very near to the appearance of the adults and only their two unequally elongated tail feathers marked the difference.

In every age the colour of the feet is the same: Tarsus blue, the heels with black markings, toes and webs entirely black.

For the zoological museum in Copenhagen was collected the skins of 11 full-grown birds and 2 chicks, and also 4 full-grown young ones in spirit and 12 eggs.

The following measures have been taken:

Sex	Age	Date	Locality	Wing mm.	Bill mm.	Tarsus mm.	
♂	ad.	20/6 08	Stormkap	303	26	43	
♂	-	17/8 06	—	301	26	41	
♂	-	17/8 06	The ship's-harbour	293	27	41	
♂	-	27/8 06	Hvalrosodden	292	29	40	
♀	-	20/6 08	Stormkap	301	29	41	
♀	-	9/6 07	—	305	27	42	
♂	juv.	13/8 06	Koldewey-Islands	269	30	38	Throat, abdomen and mantle strongly mottled. Tail feathers but little elongated.
♂	-	22/8 06	Hvalrosodden	289	28	42	The back mottled. The one tail-feather full-grown, the other quite short.
♂	-	17/8 06	The ship's-harbour	289	26	40	Normally coloured; neck yellow, tail-feathers little elongated.
♂	-	13/8 06	Koldewey-Islands	285	25	41	Mantle and breast mottled. Tail-feathers of unequal length.
Fledgling		17/8 06	The ship's-harbour	242	25	40	Pale variety.
—		Aug. 06	—	236	25	40	In spirit. —
—		19/8 06	Stormkap	237	28	42	In spirit. Dark variety.
—		Aug. 06	—	243	30	43	In spirit. Pale variety.
—		19/8 06	—	269	25	38	In spirit. —

Eggs.

Date	Locality	No.	Length mm.	Breadth mm.
29/6 08.	Stormkap	1	56	40
		2	56	40
30/6 08.	—	1	51	36
		2	51	36
26/6 08.	—	1	53	36
		2	53	36
20/6 08.	Stormkap	1	51	39
		2	49	38
22/6 08.	Snenæs	1	55	40
		2	53	39
20/6 08.	Stormkap	1	58	38
28/6 08.	—	1	55	38

Fig. 19. Buffon's Skua circling over nest.

Richardson's Skua. *Lestris parasitica* (Auctorum).

A small species of Skua appeared now and then around the ship during the navigation through the pack-ice.

I could generally identify these birds as *L. longicauda*, but in a few cases an exact identification was impossible.

The slight difference in exterior between *L. parasitica* and *L. longicauda* — especially in younger birds — in connection with the long distance at which they appeared, accounts for this.

In a certain case I think that I have identified a couple of *parasitica*, and therefore quote the following lines from my notebook.

"August 15th 1906 (lat. 77° 20′ n.). The ship is lying in a very extensive opening in the ice — some 20 km. long & 10 km. broad with a few larger flakes of ice in drift. The northern part of the opening ending in thickly packed ice-bergs. The coast free from ice. Many birds near the ship.

Amongst others a couple of Skuas, which I, almost with certainty record as *L. parasitica*. Both the birds seemed to be extraordinarily dark with a paler shade on the lower part of the neck or perhaps on the fore-breast. The elongated rectrices were absolutely shorter and seemed broader than in *L. longicauda* in full plumage; the flight appeared heavier, and the general impression of the birds was larger. Nearest distance about 50 meters."

The Pomatorhine Skua. *Lestris pomatorhina* (Temm.).

August 6th 1906 I observed a Pomatorhine Skua on lat. 75° 49′ n., long. 12° 10′ w.; it passed the ship, which was surrounded by strongly packed ice.

I met with no other specimen of this species.

Black Guillemot. *Cepphus grylle* (L.).

Solitary old birds in summer plumage appeared twice in the pack-ice on the voyage outwards namely August 1st (lat. 75° 20′ n., long. 8° w.) and August 2nd (lat. 75° 40′ n., long. 10° 10′ w.). While the Black Guillemot did not appear in the summer of 1907 in the waters by Danmarks Havn — these being constantly ice-covered

— it occurred frequently, though not in great numbers, the next summer.

The Black Guillemots especially stayed near the little rocky island Maroussia in the field-ice. Here several spots became free from ice early in the season, and the low steep rocks of the island afforded favored nesting localities.

When I visited the island July 18th 1908, I saw 5 to 6 breeding females, and some old birds in full plumage lying in the water in the neighbourhood.

Even in the ship's-harbour, quite near the coast, some Black Guillemots appeared this summer and swam fearlessly around the ship.

Old birds as well as young were observed here.

Koch's north-going sledge-party met in the summer 1907 — just off Mallemukfjeldet (lat. 80° 10′ n.) — with a great deal of open water in which 3 Black Guillemots were observed June 10th.

July 1908, during the homeward navigation through the pack-ice, I observed several times solitary Black Guillemots (as far North as 78°), all old birds in full plumage. In the stomachs of the few birds I secured for examination, I principally found remnants of crustaceans and in a single case *Chætopoda.*

For the zoological museum in Copenhagen were collected the skins of two young birds (the wing spot mottled) and in spirit an old female in full plumage. The following measures have been taken:

Sex	Age	Date	Locality	Wing mm.	Bill mm.	Tarsus mm.	
♂	juv.	15/7 08	The ship's harbour	160	30	32	
♀	jun.	15/7 08	—	160	30	32	
♀	ad.	18/7 08	Maroussia	172	31	31,5	In spirit.

Brünnich's Guillemot. *Uria arra* (L.)

As the ship on its voyage to Greenland passed Jan Mayen (July 28th 1906; about 70 km. east of the island) these Guillemots appeared in extremely great numbers. The birds occurred solitary, in couples and in smaller flocks, and were so fearless, that they flying or swimming often came within a distance of but 3 to 4 meters.

No Guillemots were seen while we sailed through the ice, and during the expedition's stay in the country only two males were recorded; they were swimming in Danmarks Havn and were at last shot near the ship (July 13th 1908).

On the voyage homeward I observed a great many Brünnich's Guillemots just outside the ice (lat. 74° n., long. 5° 30′ w. August 1st).

They were lying in smaller flocks in the heavy swell together with great numbers of Little Auks, diving for food.

In the next 3 days i saw some old females — accompanied by their hardly full-grown young ones — passing the ship.

The skins of the before mentioned two males were brought home for the zoological museum in Copenhagen.

The following measures have been taken:

Sex	Age	Date	Locality	Wing mm.	Bill mm.	Tarsus mm.
♂	ad.	14/7 08	The ship's-harbour	213	32	35
♂	ad.	14/7 08	—	218	33	37

Little Auk. *Mergulus alle* (L.).

On the voyage to Greenland the little Auk was first noticed July 28th 1906 near Jan Mayen; only a few birds were seen.

The next day more, but not very many, were seen. The birds were lying in small flocks rocking on the waves sometimes close to the ship. I newer saw them flying; they always evaded the ship by diving.

In the sea-ice only one bird was seen (August 2nd; lat. 75° 40′ n., long. 10° 10′ w.).

This species was not noticed with certainty while the expedition stayed in the country.

On the voyage homewards we suddenly in scattered ice flakes came upon great numbers of Little Auks July 30th 1908 (lat. 75° 20′ n., long. 9° 39′ w.). The birds were frequently lying on the floating ice-flakes in flocks containing some 50 individuals.

I also observed them swimming quite near the ship in search of food on the surface of the sea. A few were seen in couples.

Many Little Auks were lying in the heavy swell just outside the ice (August 2nd lat. 74° n., long. 5° 30′ w.). Farther south this species did not appear.

I found remnants of crustaceans and a few plants in the stomach of a bird killed July 30th 1908.

For the zoological museum in Copenhagen the skins of two adult birds were collected.

The following measures have been taken:

Age	Locality	Wing mm.	Bill mm.	Tarsus mm.
ad.	The field-ice	120	13	22
ad.	—	113	15	22

Razorbill. *Alca torda* (L.).

Koch, Bertelsen and the Eskimo Gabrielsen observed a solitary Razorbill lying in the open water at Mallemukfjeldet June 9th 1907.

Koch says, that they were so near the bird, that there could be no mistake as to the identification.

This species was not observed in any other place.

Gyrfalcon. *Falco gyrfalco* (L.).

The Gyrfalcon was by no means numerous as a breeding species in the regions explored by the expedition.

Only 5 nests were found, and one of these could not be identified with certainty.

In the autumn of 1906 this species occurred however extremely commonly on migration probably because the Lemmings were so numerous that year.

From August 20th until the end of September not a single day passed in which one Gyrfalcon at least was not seen either in the neighbourhood of the ship's-harbour or on Koldewey-Islands, Stormkap or Hvalrosodden. The migration culminated in the first week of September.

The falcons appeared most numerously near the ship to which they were allured by the pigeons of the expedition. From September 3rd to 17th 17 falcons were shot here. Often 4 to 5 individuals would appear at one time either circling around the mast-heads, on which they sometimes settled, or sitting around on the surrounding hummocks of ice or blocks of stone, watching for pigeons.

As soon as these were started in the air, they were most violently pursued by one or several falcons which, however, never succeeded in capturing a pigeon.

I often saw a falcon and a pigeon manoeuvering for a long while extremely high up in the air until the pigeon finally — swift as an arrow — vertically shot down to the ship and entered the pigeon-house, which was built on the deck, all the while pursued by the falcon, which stretching its talons forward and uttering angry cries would only give up the chase just before the entrance-hole of the pigeon-house. During this autumn 40 falcons were shot — all of them young birds, and at least 5 times as many were seen.

I found only Lemmings in the stomachs of birds from this autumn. September 25th the migration could be considered finished.

One Gyrfalcon appeared quite accidentally November 1st [on a skerry near the Teufelkap].

The next autumn proportionally few falcons were observed; the reason for this certainly being the great reduction in numbers of Lemmings evidently caused by the severe winter 1906—07.

I was unable to note any regular migration in spring.

In the two summers the first falcons were observed respectively May 1st and April 20th. The last mentioned observation was made at the falcons-eyrie on Nordre Orienteringsø.

The most northerly lying point, on which the Gyrfalcon was observed, was in Independence Bay at lat. 82° n.

Here Bertelsen and the Eskimo Tobias Gabrielsen recorded a falcon May 26th 1907.

I only succeeded in making relatively few observations regarding the breeding of the Gyrfalcon. Only one of the nests found was accessible viz. that on Nordre Orienteringsø.

May 19th 1907 I shot an old female at this nest; judging from her exterior she must have been sick, certainly from an inflammation of her oviduct. In her ovary were found 5 rather developed eggs. She had very pale plumage and orange-yellow feet. In the nest was lying a fresh egg, which on one side had a crack caused by frost. Like the other eyries observed, this one was conspicuously marked by heaps of excrements and remnants from the meals of the birds such as pellets, bones and other remains of animals. It was placed only 10 meters above the level of the sea on the northern side of the rock, which rises precipitously and steeply from the Stormbugt.

Judging from the enormous heaps of excrements the nest had certainly been inhabited for many years. The bottom of the nest was formed only by the excrements of the birds.

A falcon flying out from this nest was observed July 14th in the same year, so the male must within a short time have found another mate.

The next spring the female falcon was observed at the nest already April 20th. The breeding did, however, not commence before May 26th.

I often passed the nest and thus had good opportunity to observe the breeding falcon.

She kept very close on the nest, and did not leave it, even if I approached to the very side of the rock, only stretching out her neck to eye me anxiously. The male used to sit on the projections not far from the nest.

June 22nd I arrived together with two of my companions in a dogsledge at the eyrie of the falcon, intending to secure the young ones now supposed to be hatched.

The 4 eggs were, however, not yet hatched, but I could plainly hear the hoarse cries of the young ones within. The shells were still unbroken with exception of one, that had an insignificant crack. I kept the eggs warm by putting them under my shirt against my body.

Having sledged for some hours we arrived at my station at Stormkap, and here I continued my brooding of the eggs in my sleeping-bag.

The first of the young ones emerged on June 23rd the next three 24 hours later. The time of incubation for this clutch of eggs was thus nearly 29 days.

The female Falcon behaved very anxiously when I ascended the rock and she very unwillingly left her nest. Several times she rushed swiftly and vigorously towards the disturber. The male, which proved very cautious, left the rock, when the female was shot.

Both the falcons had a very pale colour; the feet of the female were lemon-yellow; she was much bigger than the male. June 8th 1908 I found another nest of Gyrfalcon on the steep northern side of the mountain Trekroner. This nest was placed at least 200 meters over the level of the ground and was quite inaccessible.

The enormously high heaps of excrements around the nest formed a large whitish-yellow ledge and could be seen from a distance of 3 km. Around the eyrie a colony of Barnacles (*Anser leucopsis*) had their nesting places. I was surprised to see, that the Geese were sitting in couples on the projections close to the Falcons.

When I — by means of a pair of rifle bullets — caused the breeding falcon to fly out of her nest, she and the male circled around the mountain in company with the Geese for a long while. From a dizzy height the falcon at last swift as an arrow shot down to the nest and was soon followed by the Barnacles, which again confidently took their seat close by.

This eyrie also looked as if it had been used from immemorial time.

Falcons eyries were also recorded on the high rock Teufelkap and on a rock near the Mørkefjord; both of them were — like the two already mentioned nests — built on the northern side of the mountains. This was also the case with the 5th nest of a bird of prey, which was found, and which certainly also belonged to a Gyrfalcon.

This can hardly be considered accidental; perhaps the falcons choose to nest on places, which in the coldest time of the day and night are warmed by the midnight sun; it must be remembered, that the breeding-time is partly in May, in which month the temperature of the nights is usually some degrees under zero.

The Gyrfalcon of N. E. Greenland must mainly feed on Lemmings; this has been proved as well by examinations of stomachs as by analyses of pellets. At the nesting-places I have however also found remnants of *Lagopus mutus, Emberiza nivalis* and — seldom — of small waders as for instance of *Strepsilas interpres* and *Ægialitis hiaticula.* [See: *Phalaropus fulicarius.*] I have also found a few remnants of Alpine Hares.

I very often observed the mutual behaviour of Ravens and Falcons; they would quarrel in the most violent manner when they met. The battles between these two combatants, which are equal in size and power are — according to my experience — undoubtedly due to an inherited rivalry, the direct cause being the Lemmings, which also form the principal diet of the Ravens.

That the Gyrfalcon — as it has been supposed by some observers — driven by hunger should try to prey on the Raven is to my mind quite incredible.

I have set down in my diary a notice regarding a battle between these two birds fought out September 18th 1906. It reads: "A falcon was in the most violent manner attacked by two Ravens. The quarrelling birds flew for a while around high up in the air uttering angry cries, after which the Ravens descended and took place side by side on a rock evidently lurking after Lemmings, the holes of which were numerous around the place. The falcon also settled with the same intention on another rock some 50 meters from the Ravens. At my approach the birds rose again in the air and immediately continued their battle. The Ravens seemed much superior to the falcon, which therefore showed an inclination to fly away to avoid their rough treatment.

The battle at last took place just over my head, and I shot one Raven in order to make the fight more even.

Frightened by the shot the two other birds flew away in different

directions, but they soon met again, and took up the battle nearer to the coast. Here the falcon got relief from two birds of its own kin, and now the Raven was obliged to depart hastily, while the three falcons settled on the summit of a rock."

Not rarely I observed falcons pursued by Skuas (*Lestris longicauda*). At the end of August the young Skuas will frequently be sitting around on stones, still cared for by their parents, which with extreme violence will guard their offspring against attacks from falcons. The Skuas exceed by far the Gyrfalcons in ability of flight, and the falcons therefore always wish to escape the pursuit and retire to the rocks. Most frequently 3 or 4 Skuas would join in an attack; the battle would usually be fought out immensely high up in the air.

The young Gyrfalcons proved very inquisitive and but little shy. I could generally call them quite near by throwing my cap or mitten up in the air.

When wounded the falcon will defend itself bravely, lying on its back with outstretched talons.

For examination I had some 50 Gyrfalcons which showed great dissimilarities in their size, plumage and colour of feet; I must however consider them all to belong to the form *candicans*. In the majority of the young birds the feet, claws and bills were dark — almost lead-coloured. I found however in a few very pale individuals greenish-yellow feet, fully or partly white claws and very light bill.

In all the old falcons the feet were yellow — in one bright yellow — the claws and the bill pale.

For the zoological museum in Copenhagen were collected the skins af 9 older and younger birds, 3 newborn young ones and one egg. The following measurements have been taken:

Sex	Age	Date	Locality	Total length (Measured by compasses) mm.	Wing mm.	Bill mm.	Tarsus mm.
♀	ad.	19/5 07	Nordre Orienteringsø at the nest	610	410	33	58
♀	ad.	22/6 08	—	620	420	30	58
♀	jun.	26/8 06	Hvalrosodden	550	370	28	57
♀	jun.	2/9 06	The ship's-harbour	630	420	31	60
♀	jun.	6/9 06	—	630	410·5	30	60
♀	jun.	26/8 06	—	550	350	26·5	56
♂?	juv.	5/9 06	—	610·5	420	33	69
♂	juv.	26/8 06	Hvalrosodden	550·5	380	29	63
♂?	juv.	17/9 06	The ship's-harbour	570	390	28	64·5

Egg.

Date	Locality	Length	Breadth
May 19th 1907	Nordre Orienteringsø	60 mm.	43 mm.

Snowy Owl. *Nyctea nivea* (Thunb.)

The Snowy Owl occurred all the year round commonly whereever the expedition came as well on islands as along the shore and far up in the country.

At the edge of the inlandice great quantities of owl pellets were found, and North of Dronning Louises Land 60 km. up the inlandice, a Snowy Owl was observed on the Nunatak, May 17^{th} 1908. Most northerly it was observed on Peary Land lat. 82° 50′ n.

In a letter from Mylius-Erichsen dated May 28^{th} 1907 it is mentioned, that two Snowy Owls were observed at Danmarks Fjord lat. 81° n., long. 29° w. The Snowy Owls appeared most numerously on their autumn migration from the beginning of August till the middle of October.

In 1906, when Lemmings occurred abundantly, the Owls could be met with at this season very commonly. Thus I observed one night at the end of August no fewer than 7 Snowy Owls on different places of Muskusoksefjeldet North of Hvalrosodden.

Through all the summer I met with Snowy Owls in the district between Stormkap and Mørkefjord, which might indicate, that they were nesting here.

That I did not succeed in finding any nest — in spite of zealous search — may probably be explained by the tendency of the Snowy Owls to place their nests in the most inaccessible spots far from the shore.

In the montains around the head of Dove Bugt Snowy Owls were seen twice after the commencement of the dark season; this may imply, that at all events a few specimens remain in the country during the winter. If so, they must — according to observations made — stay far up the country amongst rocks, at their breeding-places.

I consider the high rocks around the Pustervig and Mørkefjord to offer just the favourable nesting places to the Owls, which on the extensive plains covered with luxuriant vegetation between Rypefjeldet and Hvalrosodden can find great numbers of Lemmings — their favourite food.

The Snowy Owls are in motion day and night; I saw them hunting even in the brightest sunlight. They like, however, especially to hunt in the late hours of the afternoon and early in the morning. At dawn I often saw them wandering from the rocks towards the coast or to the plains.

Numerous examinations of pellets and a pair of analyses of stomachs have proved, that the Snowy Owls in N. E. Greenland

almost exclusively feeds on Lemmings. In a few pellets I furthermore found remnants of *Lepus glacialis* and *Lagopus mutus.* As an exception I also found remnants of *Emberiza nivalis.* There can be no doubt, but that the Snowy Owl is a dangerous enemy to the Alpine Hare on places, where it is in want of other food; but I have had good opportunity to observe, that Alpine Hares in N. E. Greenland as a rule have nothing to fear. I often observed owls and hares sitting close to each other showing no sign of hostility. On a certain occasion quite the reverse seemed however to be the case.

One day in October I had for a while observed a Snowy Owl — an unusually big and dark coloured bird — which had settled on a block of stone on the lowest slope of a large rock.

After three hours I approached the owl, which at last — as it seemed — very reluctantly left its seat only to settle again soon after on another rock a little higher up the fell.

I judged from the behaviour of the bird, that someting unusual had attracked its attention and went to the spot, where the bird had been sitting, in order to examine the place.

Two Alpine Hares were sitting in a sort of cavern made by blocks of stones rolled down; they proved very frightened and could hardly be driven off. At last I chased the hares out of their shelter whereupon they sat watching and nervously striking the ground with their hind legs till they soon after with surprising rapidity rushed back to the cavern. It seems evident to me, that the fright of the hares was caused by the owl, which had certainly made an attack on them, and was now sitting awaiting their return from the cave.

The Snowy Owl could most frequently be found on large meadows and marshes chiefly with a single large stone, on elevated ground or on table-lands with rich vegetation and scattered rocks.

To such places many Lemmings resorted, and the owls could consequently find plenty of food without running the risk of being surprised by enemies.

The owl-roosts were always marked by heaps of pellets, excrements and feathers lost by moult.

The owls used to sit on their favourite spots for hours — sometimes certainly for some 12 hours. If one knows the hunting district of an owl well, he will always with certainty be able to foretell where the scared bird will take its next station; so invariably will it make use of its once selected hunting-places.

In the dusk and by night, when the Lemmings venture to go farther around, the Snowy Owl will hunt them, flying Kestrel-like and keeping itself on flapping wings ower a certain spot before it strikes.

In Snowy Owls I never found that confidence and curiosity, which is characteristic of other arctic birds. It always proved extremely vigilant and shy, and only a couple of times I succeeded in approaching it within rifle range.

When the owls set out over the ice to or from the islands their flight was always high and direct. Over land they generally flew lower and in zig-zags.

The cry was somewhat weak and rather unlike that of any other owl known to me.

Moulting begins in the middle of July and culminates in the first half of August, when I found numerous lately lost feathers at all the owl-roosts.

A scared owl would often lose a single flight-feather or tail-feather.

I observed some 60 Snowy Owls which varied extremely as to their size and colour. It was not difficult by use of my field-glass to distinguish the differences. The smallest owls were without exception very pale a few of them entirely white. I also observed many large and very dark owls. The skin of an old dark female was brought home to the zoological museum in Copenhagen.

The following measurements have been taken:

Wing from wrist to tip	Bill measured by oompass	Tarsus
448 mm.	49 mm.	64 mm.

Raven. *Corvus corax* (L.)

Ravens were met with almost everywhere we came, always, however, in small numbers. They were seen far inland as well as on islands and outer-skerries; even in the Nunaland, lying 60 km. up the inland-ice, a Raven was observed. Farthest North the Raven was observed February 26th 1907 at lat. 78° n.

I have not been able to notice any regular migration of Ravens. They disappeared successively on the arrival of the dark season and returned in the same way on the reappearance of the sun. The first record of Raven dates from February 9th, the last from November 4th.

I have no doubt, that the Ravens do leave N. E. Greenland in the absolutely dark season. If not, the members of the expedition would certainly not have failed to see them, as one or more

persons every day moved about in the environments of the ship. Personally I took almost every day a walk during all the winter. In a season in which the Raven could only with difficulty support life, it would certainly have appeared near the ship, if it had been in the neighbourhood. The sledge-parties of the expedition, which so frequently were on the move far and wide — also in the dark season — never discovered a Raven at this time.

A longer voyage southwards to Shannon Island and Sabine Island was undertaken by 6 men from November 13th to December 4th 1906. Though the weather was generally comparatively fine and though several landings were undertaken as well during the voyage outwards as homewards, no bird was observed. Open water was found in several places, and the surroundings of Sabine Island were entirely free from ice.

In the winter 1906—07 plenty of remnants of shot Whalrusses were lying on Hvalrosodden; they would surely have attracked Ravens if present; but the travellers, who frequently visited this spot in the dark season, observed no Raven later than November 4th.

I feel sure, that single pairs of Ravens must nest in the rocks N. & N. E. of the ship's-harbour and the surroundings of Pustervig and Mørkefjord, but no nest was recorded.

Ravens must certainly also breed on the high rocky regions of Koldewey Islands and Teufelkap. The breeding time will — as far as I can judge — be in April. Single couples may, however, breed somewhat later.

March 12th 1907 I shot a couple of Ravens — male and female — that always kept together. The testicles of the male were already somewhat developed; the eggs of the female were relatively smaller.

March 16th 1907 I observed for a long while 3 Ravens: two males violently fighting over a female.

April 25th 1908 it was reported from the meteorological station at Pustervig, that a couple of Ravens had settled on the high inaccesible mountain Monumentet, where they probably were nesting.

A couple of Ravens visited every day the ship's-harbour from May 16th to 25th 1906. The female — which at last was shot — had well-marked breeding-spots. I believe, that this couple had their young ones in the high rocks N. E. of the harbour. May 21st I secured a Raven (♀) with breeding-spots before my tent on Hvalrosodden.

The Ravens will generally wander about solitary or in couples; more seldom I observed 3 to 4 birds in company — generally young. Old birds will — according to my experience — live in couples, even outside the breeding season. I have observed Ravens assemble

in flocks — counting more than 10 birds — at large carcasses, and once near a severely wounded bear. With never failing certainty they will discover where food can be obtained. In the autumn of 1907 I stayed for a long while in the surroundings of Hvalrosodden. I moved every day for miles around in the country and observed only now and then a solitary wandering Raven until one evening — at the end of my stay — an old Musk-Ox bull was shot; the hide and entrails remained on the spot. Already the next morning early no less than 10 Ravens had found the carcass, at which I observed them on the best terms with 3 Polar Foxes.

The Lemmings absolutely form the principal food of the Ravens in N. E. Greenland; they were almost exclusively to be seen inland lemming hunting in the year 1906, when Lemmings were abundant. This year I found in every stomach examined remnants of Lemmings and almost nothing else. One single stomach of Raven contained remnants of a half-grown *Pagonetta glacialis.*

The Ravens catch the Lemmings either by sitting waiting before the entrance of their holes or by flying scouring rocky slopes or valleys. I have observed Ravens using both methods with success.

[Under the heading *Falco gyrfalco* I have mentioned the quarrels between these birds and the Raven.]

In the spring and summer 1907 the number of Lemmings was surprisingly reduced at the places, which I especially visited; the Ravens would under these circumstances mainly stay along the shores and on the ice in the firths. This year I often observed Ravens — in company with *Larus glaucus* and *Canis lagopus* — parasitic on the hunting Polar Bears. When the bear had killed a seal, the parasites would exhibit a surprising impudence and seemed by no means to fear the right owner of the prey, in the close proximity of which they took their places in order to get some of the blood, which had flowed out or what else they could procure from the meal of the bear.

Once I observed two Ravens sitting on the ice eating fresh excrements of a bear, which contained badly digested remnants of *Phoca foetida.* The Ravens appeared frequently at the breeding-places of *Sterna macrura,* but they were violently attacked and persecuted by the angry flocks of Terns.

I caught a few Ravens — always young birds — in fox-traps placed at the depots of meat of the expedition.

I have never observed Ravens attacking Alpine Hares, but it can hardly be doubted, that Ravens are dangerous enemies to quite young Hares.

Large steep rocks are the real territory for Ravens; from here

they will set out at dawn to hunt, and late in the afternoon they return to their night-lodgings with a high direct flight. When wounded or scared by a shot, they will almost always rush to the rocks.

The Ravens proved usually extremely cautious without however being really shy. Especially old birds showed extreme sagacity in their judgement of a situation. Ravens would often appear at the tents to partake of the thrown out leavings, and they soon became confident if we omitted to shoot at them or to annoy them in other manners. During a lengthy stay in a tent, MYLIUS-ERICHSEN every day had a visit of a Raven, which he fed with leavings from his meals; at last the bird became so confident, that it slept every night on the roof of his tent.

The Raven from N. E. Greenland utters flying — more seldom sitting — a cry, which differs very much from that of the European race — a high toned ringing trill, that sometimes sounds like a sort of song. I seldom heard the bird produce the usual cry of a Raven.

The skins of 6 Ravens were collected for the zoological museum in Copenhagen. The following measurements have been taken:

Sex	Age	Date	Locality	Wing mm.	Bill mm.	Tarsus mm.
♂	ad.	12/3 07	Hvalrosodden	452	78	69
♂	-	27/8 06	—	In moult	77	68
♂	-	27/8 06	—	—	81	75
♂	-	24/8 06	—	—	77	71
♀	-	23/5 07	—	437	70	72
♀	-	17/3 07	—	451	74	70

Wheatear. *Saxicola oenanthe* (L.)

May 31st 1908 I met with two female Wheatears on the gravel banks at Stormkap. From the top of large single stones the birds would rush down to the ground to catch passing insects and spiders.

When I had shot the one bird, the other became extremely shy and soon after disappeared on the other side of the gravel banks.

In the stomach of the killed bird I found remnants of spiders and larvæ of butterflies (*Dasychira Groenlandica*).

The country — especially at Stormkap — offered the most excellent locality for Wheatears; the fact, that the species was only observed once may therefore prove, that the northern limit for its distribution is here surpassed.

According to H. Winge: "Grønlands Fugle" this bird breeds so far North on the East coast of Greenland as lat. 75° n. (On Shannon.) Bay observed it commonly in the inner part of Scoresby-Sound.

On the skin brought home the following measures have been taken:

Wing	Bill	Tarsus
94·5 mm.	13 mm.	28 mm.

Redpoll. *Cannabina linaria* (L.)

The Redpoll appeared a few times in the migration-season, but it was not found breeding.

Dr. Lindhard reports to have observed a Redpoll near his tent on Kap Marie Valdemar August 18th 1906; two days later he saw a smaller flock on Rosio Island.

September 9th 1907 I observed a Redpoll — certainly a young bird — in company with some Snow-Buntings on Harefjeldet near the ship's-harbour. In contrast to the Buntings the Redpoll proved confiding and rather curious; several times it hopped around on the ground just before my feet.

In the oesophagus of the bird I found seeds of plants, especially *Luzula*.

April 18th 1908 I again saw this species on Harefjeldet (3 individuals). One of them was secured; the oesophagus of this bird was also filled with seeds of plants (*Cyperacea* and *Luzula*).

August 19th I heard twittering from flying Redpolls near the ship's-harbour, but I did not succeed in observing the birds in the bright sunshine. The skins of two birds were brought home to the zoological museum in Copenhagen.

The birds had been so damaged by the shot that an anatomical determination of the sex was impossible.

Both the birds belong to the pale subspecies [var. *canescens*].

The following measurements have been taken:

Sex	Age	Date	Locality	Wing mm.	Bill mm.	Tarsus mm.
♀?	ad.	18/4 08	Harefjeldet	81	9·5	16
?	?	9/9 07	—	80	9	16

Lapland Bunting. *Emberiza lapponica* (L.)

The occurrence of the Lapland Bunting is, according to my experience, quite accidental in N. E. Greenland.

June 17th 1907 and old male was seen in a little bog on Lille Koldewey in company with some Snow-Buntings picking up the seed of plants.

The bird proved so confiding, that the observers could leisurely study it at a distance of a few paces.

Snow-Bunting. *Emberiza nivalis* (L.)

The Snow-Bunting is absolutely the most common of all birds in this country.

Snow-Buntings were seen wherever the expedition went as well in Dronning Louises Land (60 km. up the inland ice) as on the, small outer isles and skerries, lying near the pack-ice, where several nests were found.

I have received from the north-going parties of the expedition the following notes regarding the occurrence of this species farther North:

"April 29th 1907. lat. 80° 30′ n. Many Snow-Buntings on the bay near land".

G. Thostrup.

"May 7th 1907. Peary Land. [lat. 82°—83° n.] 6 Snow-Buntings were seen in a flock to day".

Bertelsen.

"May 13th 1907. lat. 83° 30′ n. 4 Snow-Buntings in a flock and also some solitary individuals".

Koch & Bertelsen.

"June 4th 1907. lat. 81° 15′ n. On the edge of the inland ice, which here faces the open sea, about two Danish miles (ca. 15 km.) from the nearest ice-free land, some 10 Snow-Buntings were observed in a flock. Gabrielsen found a dead Snow-Bunting here".

Koch & Bertelsen.

As well in 1907 as in 1908 the first Snow-Bunting appeared at the ship's-harbour April 5th. In 1908 Mr. Freuchen observed the first Snow-Bunting the very same date at the house of the observation station in Pustervig. The migration of the Snow-Buntings lasted however through the whole month. The males arrived first. Low temperature [÷ 30° and still lower] and frequent snow-storms often made it difficult for the hardy small birds to support life.

In very severe weather the Snow-Bunting would often fly to the winter house at the ship's-harbour or to the ship. They ate with great greediness crumbs of bread, grains of barley, rice etc., thrown out for them.

In fine weather the flocks would fly around on lower lying snowless spots generally near the shore; they spent the nights up country and took their rest on steep rocky walls inaccessible to Polar Fox and Ermine.

I often observed, that Snow-Buntings at evening would crouch together in cracks and other natural hollows in rocky walls to find shelter in this way from the cold of the night.

Already in the first days of May I saw a few — certainly very old — males in full summer plumage accompanied by their mates. In fine weather the couples stayed by the nesting-places and the males were singing at the top of their voice. In snow-storms and bad weather they would again join the flocks wandering around; in these were still many males, which were far from being in full plumage.

The flocks were certainly considerably diminished at the end of May, and Snow-Buntings in couples could be seen everywhere: it took, however, some two weeks before the shedding of the feather tips of the younger birds was finished and the pairing of all birds took place.

The nesting-places are rather varied, but by far the majority of the nests are placed in heaps of stones lying isolated and surrounded by relatively fertile plains or meadows; such places are undoubtedly chosen on account of their rich insect life. However I also found some nests in cracks in the rocks, beneath stones lying on the ground, and on similar spots.

The birds make a relatively large cup-shaped hollow in the surface of the ground or in the sand blown into the cracks; in this hollow they will later on build the real nest and in such a way, that the edge of the nest, which consists of moss and stiff straws, is level with the surface. In the nests I saw, the materials used as lining consisted of hair (Fox or Musk-Ox) and feathers (Ptarmigan, Skua and in a few cases Snowy Owl).

When the female is searching far and wide for materials for the nest, she is always followed by the male, which entertains her by his lively chirping and song, also when she is busy in the nest arranging the collected materials, but he takes no active part neither in the nest building nor in the brooding of the eggs.

All day and night he can with but short interruptions be seen near the nest diligently singing, either sitting on his elevated favorite place ore rising some few meters in the air.

Eggs were found from June 6th to July 18th. The number in a

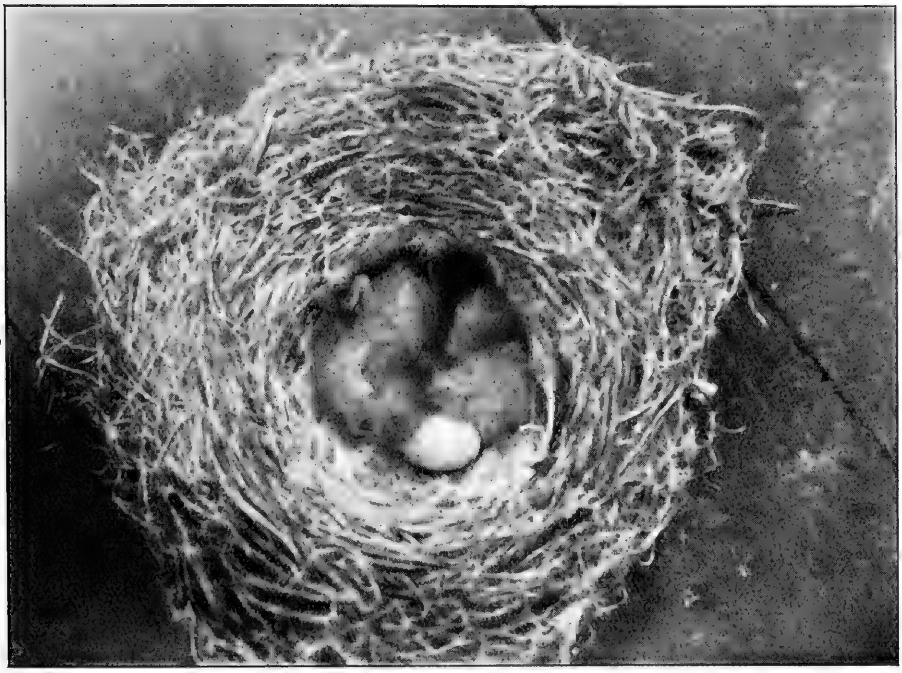

Fig. 20. Nest of Snow-Bunting (removed from its site).

clutch was most frequently 5 or 6, seldom 4. In a certain case I found a Snow-Bunting breeding on 3 eggs.

The young ones were exclusively fed with insects, which were brought with equal perseverance by both the parents day and night. When the young ones are 11 to 12 days old they will leave the nest, although they are hardly able to fly.

At the middle of July I saw and heard young Snow-Buntings everywhere sitting on stones and rocks; for some few days yet they were fed by the parents.

At the end of July I observed the first old male in autumn moult; this came on so suddenly, that the birds were almost unable

to fly. High up in the mountains I often met with flocks of such moulting males the rectrices of which were hardly more than 2 cm. long; the whole of their plumage was very worn, and the usually so neat birds had an almost ridiculous exterior.

During the whole moulting time the males stayed up in the mountains probably because they were here not so exposed to attacks from the falcons. The moult of the females began a little later and proceeded more slowly; they might while moulting also be met with in the lower country, but never in company with the flocks of younger birds, that flew around. Having finished their moult the old birds would leave the country in the first half of September. Numerous flocks of young might be seen during most part of October; they usually sought food — exclusively vegetable — on plains near the shore.

A few laggards — all young birds — were observed in the first days of November. Snow-Buntings were not seen later than November 10th.

For the zoological museum in Copenhagen were collected the skins of 19 old birds; further some young ones in spirit and 14 eggs [3 clutches]. The following measurements have been taken:

Sex	Age	Date	Locality	Wing mm.	Bill mm.	Tarsus mm.	
♂	ad.	17/5 08	The ship's-harbour	112	12	23	Back black, head white.
♂	-	25/5 08	Stormkap	109·5	10	20·5	
♂	-	6/5 08	The ship's-harbour	112·5	11·5	20·5	A few pale edgings on the dorsal feathers. Head white.
♂	-	25/5 08	Stormkap	112	12	23	
♂	-	28/4 08	The ship's-harbour	109	12	21	Back black with narrow pale edgings on the feathers. Head white with a slight brownish tinge.
♂	-	6/5 08	—	112	11·5	22·5	Conspicuous white edgings on the back and a brownish tinge on the crown of the head.
♂	-	25/5 08	Stormkap	109	11·5	21·5	
♂	-	28/4 08	The ship's-harbour	107	11	22	
♂	-	28/4 08	—	116	12	22	
♂	-	13/5 08	—	112	12	21·5	A marked rusty shade on head and hind neck.
♂	-	28/4 07	—	110	12	22	
♂	-	28/4 08	—	108	12	22·5	Broad pale edgings on the dorsal feathers.
♂	juv.?	6/9 07	—	112	12	20·5	
♂	juv.	13/9 07	—	108	12	23	
♀	ad.	31/5 07	—	104	12	21	Back dark. No trace of brown on the crown of the head.
♀	-	27/5 08	Stormkap	102·5	10	21	Back dark. Slight tinge of brown on the crown of the head.
♀	-	25/5 08	—	105	11	23	The back rather pale. Forehead brown.
♀	-	12/5 07	Koldewey Islands	104·5	11	21	The back pale. A brown shield on the forehead.
♀	-	28/4 07	The ship's-harbour	100	11	22	Back and rump brownish. The crown of the head decidedly brown.

Eggs.

		Length mm.	Breadth mm.
23/6 08. Stormkap.	1	24	17
	2	23·5	17
	3	23	17
	4	23·5	17
23/6 08. Stormkap.	1	24	17
	2	23	17
	3	23	17
	4	23	17
	5	23	17
24/6 08. Stormkap. 6 eggs in the clutch, one of them is broken.	1	22	16
	2	21	16
	3	21	16·5
	4	21·5	16
	5	21·5	16

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18—10—1910.

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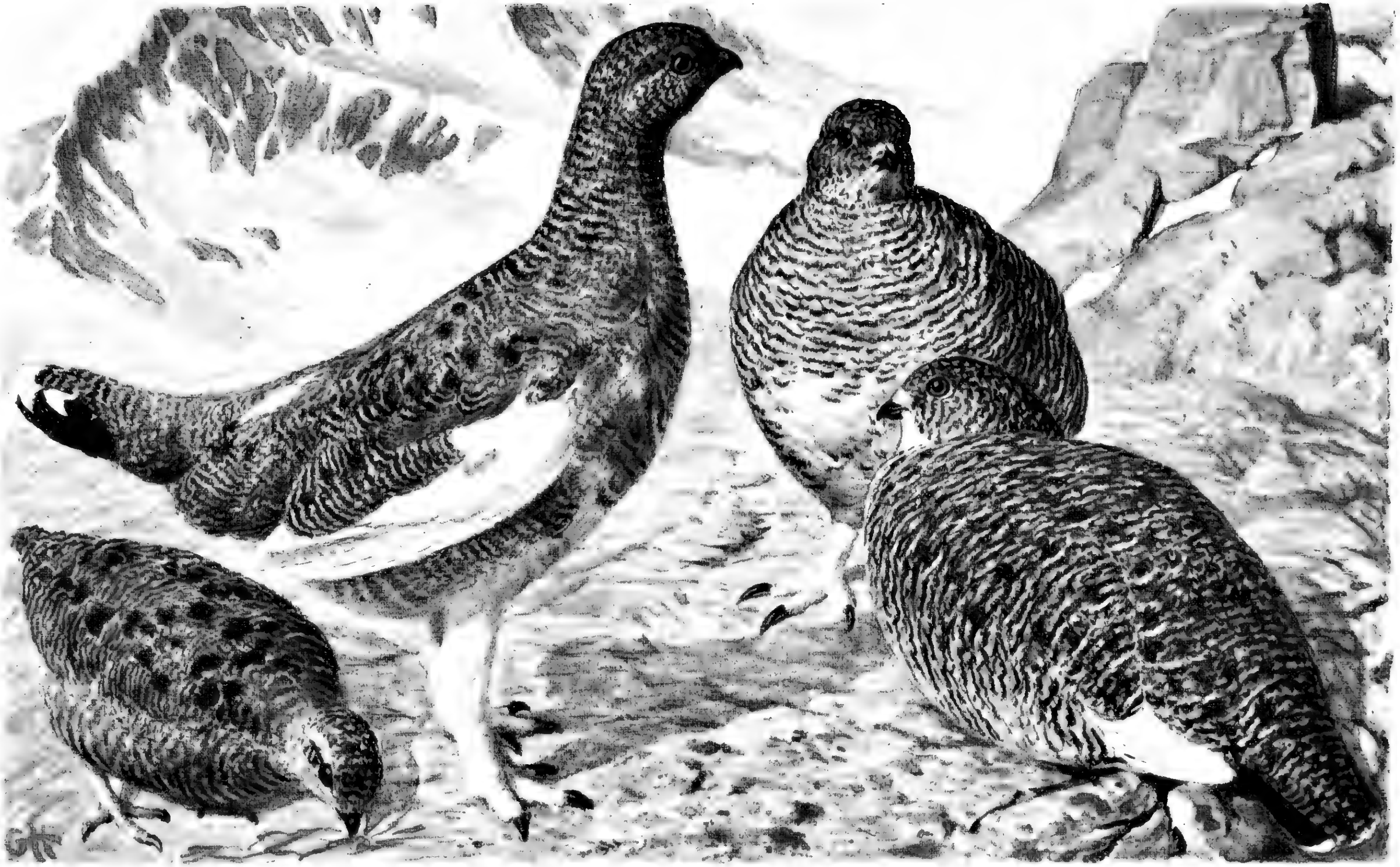
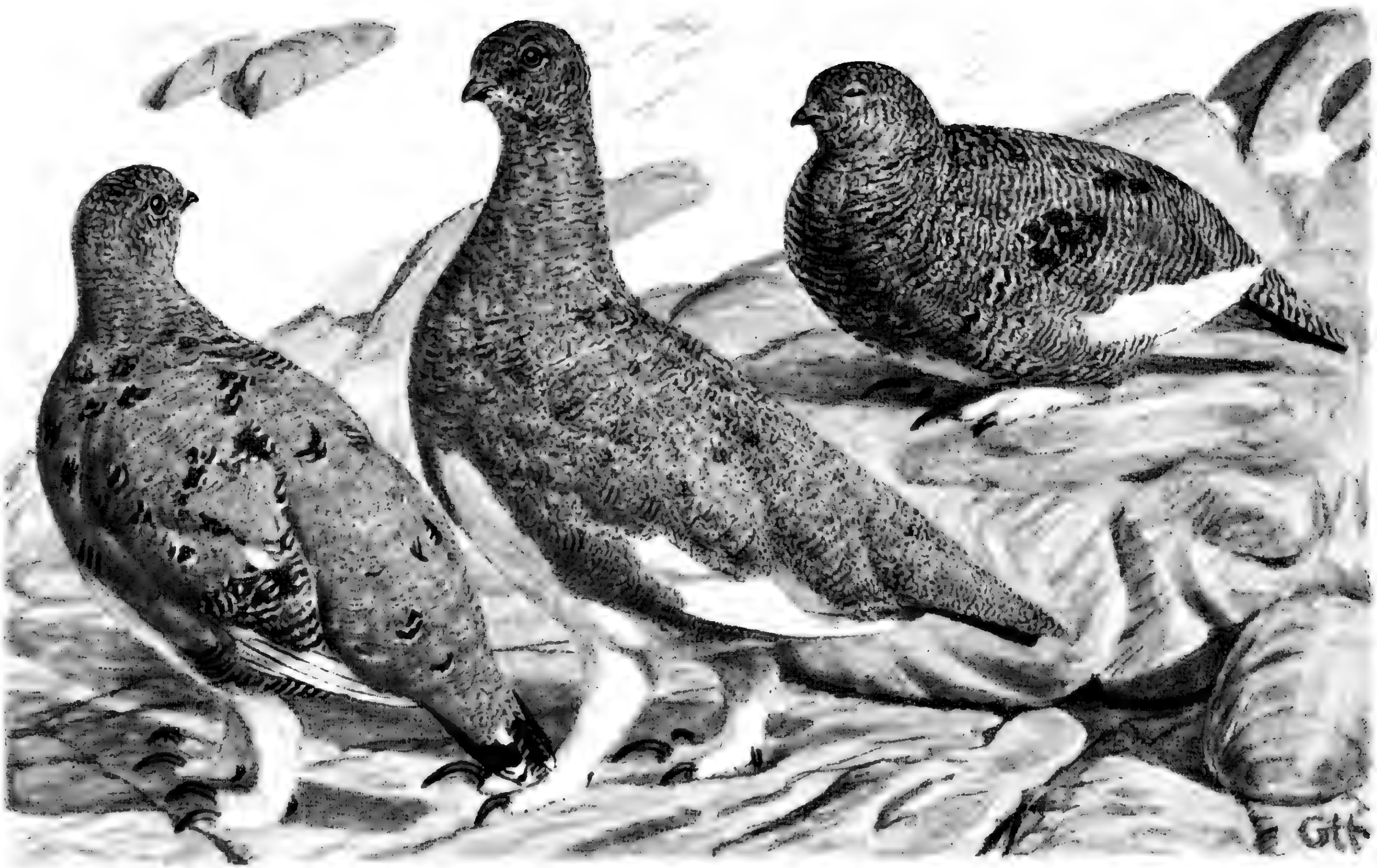
4 1

GERHARD HEILMANN PINX. *CANIS LAGOPUS* H. H. THIELE IMP.



juv. juv. ♂ ♀ ad. summer

GERHARD HEILMANN PINX. *LAGOPUS MUTUS* H. H. THIELE IMP.



♀ ad. autumn ♂ ad. autumn ♂ ad. summer

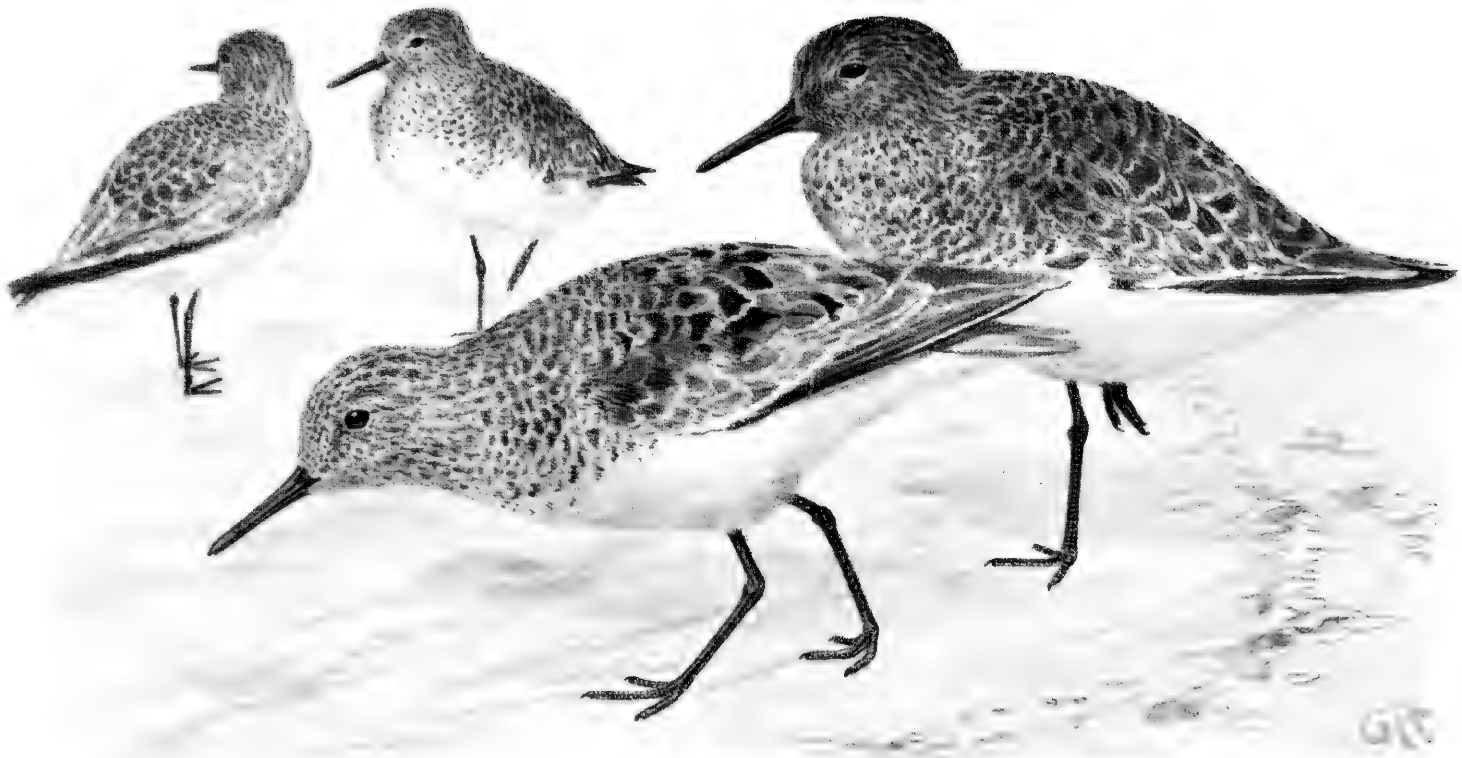
LAGOPUS MUTUS

Gerhard Heilmann pinx. H. H. Thiele imp.

newly hatched 3 days old

7 days old 11 days old

GERHARD HEILMANN PINX. CHICKS OF *CALIDRIS ARENARIA* H. H. THIELE IMP.



GERHARD HEILMANN PINX.

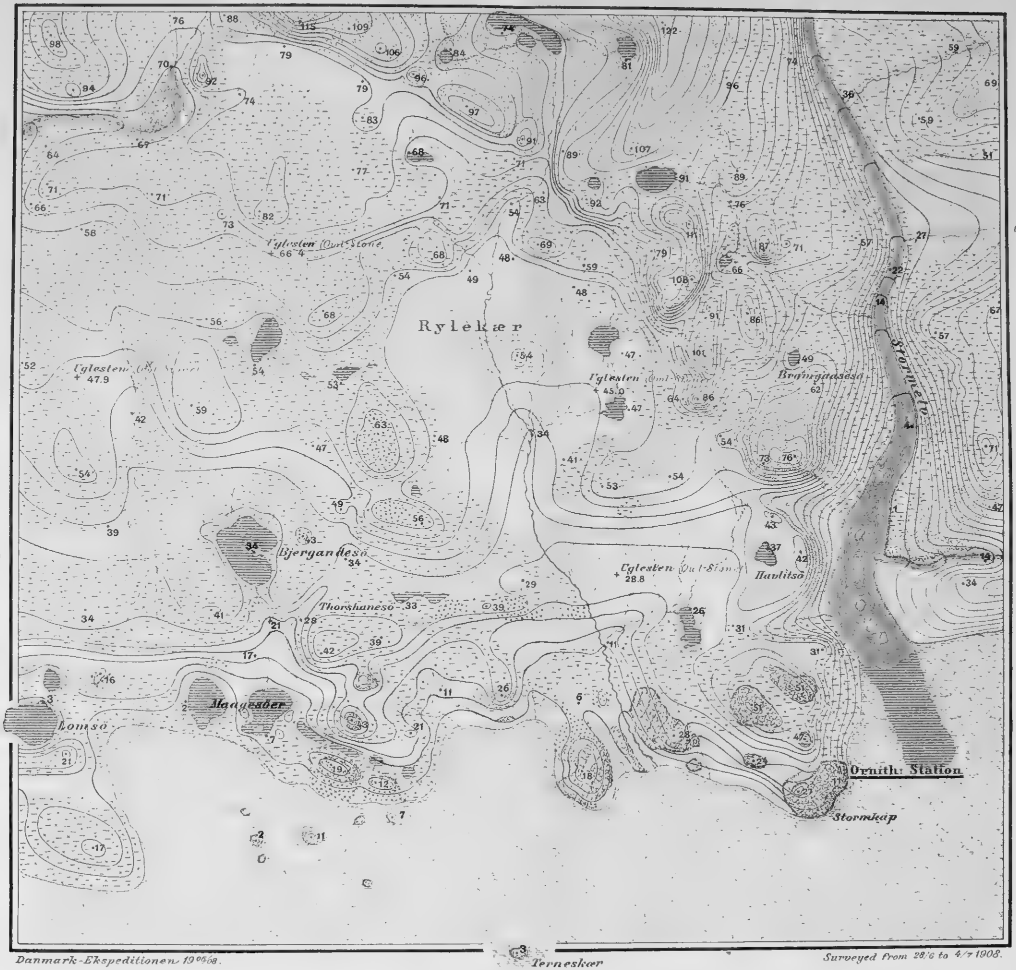
CALIDRIS ARENARIA

H. H. THIELE IMP.

Eggs of *Calidris arenaria*, different types
Eggs of *Larus sabini*, one clutch

GERHARD HEILMANN PINX. H. H. THIELE IMP.

PART OF WINGE'S COAST.



Snedrive.
(Snow-drift.)

Sö (aabent Vand)
Lake (Open water.)

Fjordis med Vandkanaler.
(Ice on the frith traversed by channels)

Kær.
(Moor.)

Höjdetal i Meter.
(Heights in Meter.)

Præstekraveterræn.
(Ringed Plover-Territory.)

Sandlöberterræn.
(Sanderling-Territory.)

Snespurveterræn.
(Snow-Bunting-Territory.)

Grusbanker.
(Gravel-Bank.)

Grundfjeld.
(Primitive Rock.)

Danmark-Ekspeditionen 1906-08.

Surveyed from 28/6 to 4/7 1908.

Scale 1:25000.

1000 m 500 0 1 2 Kil.

Axel E. Jasmodt, Kjøbhvn

II.

OBSERVATIONS ON SEALS (PINNIPEDIA) AND WHALES (CETACEAE)

MADE ON THE DANMARK-EXPEDITION 1906—08

BY

FRITS JOHANSEN

Fig. 1. A dead male Walrus. Danmarks Havn $^{31}/_{7}$ 1907.

The stretch of country which has been mapped out and in part scientifically investigated by the Danmark-Expedition, extends from the Shannon Island in the south (ca. 75° N. L.) to Kap Bridgman (ca. $83^{1}/_{2}$° N. L.) in the north and Kap Glacier (81° 33′ N. L., ca. 31° W. L.) in the north-west.

The mapping of the country refers not only to the course of the outer coast and its larger or smaller islands, but also to the fjords right in to their innermost branches (only some few fjords were not followed quite to their head), and also to Dronning Louises Land and the margin of the inland ice.

Such an enormous stretch of land can naturally only be examined in a fleeting manner at many places; the districts lying nearest to Danmarks Havn (76° 46′ N. L.) have been the more often travelled over by the members of the Expedition, whilst the places farthest off (the most northerly) have only been investigated on one occasion, namely, on the great northern journey in April—November 1907. But as the latter was taken part in by several sledge parties, sent out with different aims and returning at different times, the information regarding these northerly regions is quite copious, and to this may be added the circumstance, that one of the sledge parties was obliged to pass the summer in Danmarks Fjord and was thus able

to obtain information regarding these regions, at a time when it was not possible to visit them from the ship's harbour.

With regard to the investigations on the seals[1], the following may be observed. The northern boundary for the (in summer) open coast and fjord water in those regions lies at 77°—78° N. L. South of this boundary the seals have very much the same biological conditions; except that the thickness of the fjord ice is greater further north and that the ice freezes more quickly and more completely in winter further up in the fjords, whilst on the outer coast and in the ice-fields larger and smaller channels or openings are formed throughout the whole winter. As will be seen from the following, however, there are differences in the ice-conditions in the fjords from year to year, according as the ice melts completely or only in the outer parts of the fjord.

North of ca. 78° N. L. however, quite special ice-conditions occur, as a glance at the chart will show. In the whole of Jökelbugten (ca. 78° N. L. to ca. 79° N. L.) between Lamberts Land and Hovgaards Ø the inland ice joins on to the offlying, many year old coast-ice; here no openings or channels occur which the seals might use, nor are these animals ever observed here. Whether they occur at the long row of islands (Norske og Franske Øer) which lie about ca. 78—ca. 79° N. L. is not known, but as they are found at Ile de France, which is as it were the most southerly outpost of the islands, this is quite probable.

Between ca. 80° N. L. and ca. 81½° N. L., on the other hand, favourable conditions for the seals occur, as the open sea lies just off Holms Land, so that there are sometimes large openings with ice-free water or this is covered by thin ice, during the season at any rate when expeditions have been there (April, May, June and October).

The western part of the Wandels Hav and the east coast of Peary Land right up to Kap Bridgman (ca. 82°—ca. 83½° N. L.) are quite filled with screw-ice, a mixture of old fjord ice and refrozen drift ice, which is just as little suited as Jökelbugten to the habits of the seals (the observations are only for the month of May).

On the other hand, at any rate in summer (June—August), there is open water as openings or channels along the coast of Independence Sund and the Danmarks and Hagens Fjords opening from it (ca. 80°—82° N. L., ca. 20°—30° W. L.), and seals have also been seen here at this time of year.

It will be understood from the above, and when the nature and manner of working of the Expedition are considered, that seals

[1] As the whales are not restricted to the coasts, they are not considered here.

were observed along the coast north of ca. 78° N. L., when the sledge parties chanced upon open water or drove over thin ice; further their remains were found at the Eskimo settlements, which lie scattered along the whole coast (more numerous at some places than at others), except when these settlements were so much covered by snow that they escaped attention. Between ca. 76° and ca. 78° N. L. the investigations on the seals extend over practically the whole year, and that especially round about the ship's habour.

In this account it is superfluous to mention all the places where seals (and whales) were seen, killed or their bones found in North-East Greenland; so much the more since several of them (*Trichechus rosmarus, Phoca barbata, P. foetida*) are found, as known, far up in the north, either in the sea outside or on the coasts, elsewhere in similar latitudes, and they naturally have a corresponding distribution on the north-east coast of Greenland, so far as the special natural conditions, which some (*Phoca barbata*) require, are to be found. With regard to others (*Phoca groenlandica, Cystophora cristata, Balaena* sp., *Balaenoptera* sp., *Monodon monoceros*), we know so much about their distribution at North-East Greenland from earlier observations, that the results of Danmark-Expedition, on which they were only seen on the voyage in to and from the land or their bones[1] found here or there, can only serve as a supplement, and at the most give a more precise northern limit than that hitherto known for a few, not high-arctic species (*Orca gladiator, Globiceps melas*).

[1] All the bones brought home, both those washed up and those found in the Eskimo ruins, have been determined by Vice-Inspector H. Winge, who intends to give a detailed account of the mammals and birds, whose bones were found at the settlements of the Eskimos.

Fig. 2. Female Walrus on a piece of drift-ice. Kap Bismarck 23/8 1907.

Seals (*Pinnipedia*).

Walrus (*Trichechus rosmarus L.*).

As is well-known, this seal is in high degree bound to the coasts, or the banks of the sea in the neighbourhood of the coasts.

The places in North-East Greenland where the walrus was met with furthest out to sea were ca. 10 miles off Store Koldewey (76° 16′ N. L., 17¾° W. L.), where a walrus rose to the surface near to the ship. The depth here was ca. 130 m., and there was much open water with scattered ice-floes, while in under the land there lay a broad belt of coastal ice; this is perhaps the reason why the walrus was seen so unusually far out to sea (12/8 06). Further, it was frequently observed in the sea or ice round Maroussia Island (76° 40′ N. L., 18° 33′ W. L.), and its bones were also common in the Eskimo meat-depots on Orléans Island (77° 38′ N. L., 17° 39′ W. L.). — With regard to the distance it goes up in the fjords, there is no limit here, provided that the ice is not thicker than it can break; it has been met with in the innermost bights, even at places, where the water was practically fresh from the outflowing rivers. This was the case at Hvalrosodden (76° 54′ N. L., 20° 5′ W. L.), where especially in August 1906 I had abundant occasion to observe these animals. The whole of the foreland here consists of raised

sea-bottom, here and there covered by washed-out sand and gravel from glacier rivers of earlier times. The ground is quite flat but gradually rises to about 10 m. as we go further in on the land. Seven kilometers from the coast lies an extensive lake, which extends as a narrow bight to the far distant inland ice. It was earlier a fjord, which at the present day is only in connection with Dove Bugt by means of a broad river, which flows down between clay plains and gravelly slopes. Near the place, where it flows into the sea, lies Hvalrosodden, altogether like a small, sandy peninsula on the North Sea coast of Denmark. Its point is bare sand, further in we find tufts of grass and various other plants, especially in the small depressions of the ground, and while it is almost level with the sea-bottom on the one side (where the river has its outlet), it has a steeper slope on the other (out towards Dove Bugt). It is at the latter place that the walrus comes up at nights to rest; it is also from here that it plunges into the water when it is surprised unexpectedly. As they could not stay here while we were on the spot and hunting, they changed over to the other side of the peninsula near to the outlet of the river, and we could hear their bellowing and puffing the whole night long and see the large animals rolling up on to the land. There is plenty of food for them here (mussels, whelks and larger Crustacea), and this is obviously a much more important matter for them than the salinity of the water, which is here not so salt but that one could wash oneself with soap and almost drink it.

On the other hand, the walrus is in the highest degree dependent on the different conditions as to ice, which occur in the fjord up here from year to year. In 1906, for example, the fjords round Danmarks Havn were free of ice right in to their innermost branches, and the walrus had then an unhindered passage everywhere; in 1907 the winter's ice was very thick, and only the outer parts of the fjords were free of ice in the summer; further up the meter-thick ice extended far in as an almost unbroken, wide plane and of open water there was only a narrow belt along the coasts. Consequently, the walrus was only very exceptionally seen in on the fjord ice, coming up through an opening or broader channel in the ice; the great majority however remained in the ice-free parts of the fjord or in the open sea on the outer coast, and when they wanted to rest, they then climbed up on pieces of drift-ice or on the coastal ice here and there attached to the land. The result was, that whereas in 1906 the walrus at Hvalrosodden kept together in herds of up to 20, in 1907 they were always single or only a couple together.

The walrus was observed in quantities round about Danmarks Havn and further north as far as Ile de France, (where its bones were also common) and on the thin ice at Amdrups Land (81° 10′ N. L.). At the latter place, as mentioned later, a male walrus was observed in May 1907, and bones were also found on Eskimonæsset (80° 24′ N. L.). In Jøkelbugten and north of ca. 81° 10′ N. L. it was not seen — but it is quite probable that it occurs along the northern part of the east coast where there is a good deal of open water in the summer (see Introduction).

Fig. 3. Three walrus coming up through the thin ice along the coast at Snenæs 5/9 1907. (Note the unbroken old ice in the fjord.)

It is chiefly in the summer time (June—September), that the walrus is seen in the fjords of North-East Greenland; they are seen earliest in the year on the outer coast (beginning of May), and it is also here that we meet them immediately after the beginning of the dark period (end of October), — naturally because the ice here breaks up earliest and forms latest. That it remains within the fjords some time after the formation of the thin ice, appears from the fact, that on 6/10 06 a walrus came up through a hole which had been made in the ice at Danmarks Havn (the depth of water was here 11 m.). Further, I am of the firm belief that it was a walrus I heard blowing under an ice-berg at the same place on

$^{26}/_{9}$ 07, and that they come to these places, it may be to make a breathing-hole or because there is open water in the channels between the ice-floes and the thin ice begins to be too thick to be broken through [1]. Further, walrus were twice seen ($^{28}/_{9}$ and $^{30}/_{9}$ 07) in openings in Stormbugt (ca. 76$^{1}/_{2}$° N. L.) and Danmarks Havn, but it is nevertheless remarkable that the walrus should be seen so little in the fjords at this time of year (October), although there are larger or smaller openings at many places, where the seal (*Phoca foetida*) is extremely common. When we come however to the outer coast we find many signs of the walrus: open or recently frozen-over breathing-holes in the thin ice, or this shows distinct evidence of the presence and behaviour of the walrus in the form of characteristic, hump-like elevations with radiating cracks, probably formed by the walrus in endeavouring to make an opening but later giving it up [2]; perhaps however it may rather be compared with the West Greenland "Nunarsak" (which means a breathing-hole in the ice, when this is covered with snow). Newly formed and older holes for the walrus were also seen here and there on the thin ice, in the form of oval openings ca. 1$^{1}/_{2}$—2 m. in diameter; to judge from the broad belt of water washed up and the fact that the pieces of ice thrown up lay both on the surface and on the edge, the animal probably comes up with great force, which indeed is necessary, as the thickness of the thin ice quickly becomes too much for the powers or inclination of the walrus to break through it. The breathing holes of the walrus are naturally much more numerous in the spring than in the autumn; at the former period the thickness of the ice is far too great for the walrus to break through, whereas the breathing holes (which have a diameter of ca. 12 cm.) can be more easily made and kept open. Just as in autumn it is now also necessary to go to the outer coast to find the walrus (breathing-holes were seen in the beginning of May 1907 on the ice at ca. 80°—81° N. L. and on $^{20}/_{4}$ 07 on the ice near the south point of Ile de France), while they first appear in the fjords of North-East Greenland, as mentioned, in the beginning of June.

Where the animals here live during the period from November —March, I do not know, but they are probablyobliged, for the sake of their special kind of food, to keep to the coasts; and we may therefore perhaps conclude, that it is at the outermost reefs and islands where they appear earliest and latest in the year.

The manner in which the walrus breaks the thin ice was once observed (Stormcugt $^{5}/_{9}$ 07); first they stick the head (when

[1] I believe I have observed the same thing for *Phoca foetida* ($^{1}/_{10}$ 07).

[2] Observed off Maroussia Island in October 1907; the depth here was ca. 60 m.

floating as is usual with the snout above the water) down below the surface and bend the trunk in an arch above the water; then they straighten out the back, so that the head strikes upwards on the under edge of the ice; the head goes down again and so on.

From what has been said earlier, the impression has perhaps been obtained, that the walrus prefers the open water to the ice; this only refers however to the solid and extensive fjord and coast ice which is formed in the course of the winter, but not to the drift ice, which in the form of small floes and bergs comes in with

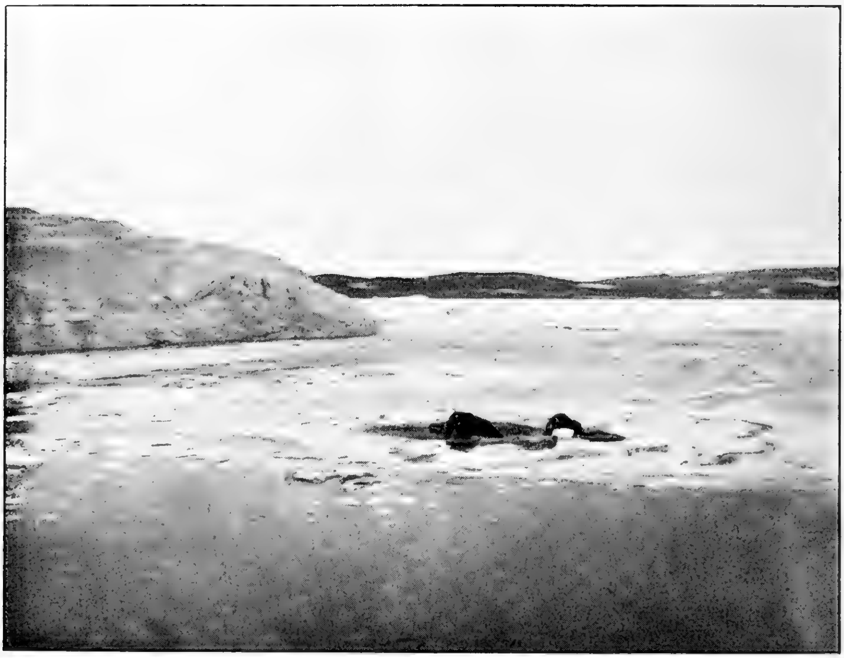


Fig. 4. Two walrus breaking the thin ice at Snenæs 5/9 1907 (to the left the coast covered with snow).

the current in the summer. On the contrary, I have observations (Hvalrosodden August 1906 and Stormkap August 1907), which show that the walrus practically follows with the drift ice, meaning therewith that it is mostly in the "clear spaces" (open water) of the drift ice, that they remain for a long time diving up and down and playing, while this is never seen in the large, open parts of the fjord or if the latteris quite free of ice. But this agrees well with the present geographical distribution of the animals on the whole (as high-arctic forms).

With regard to the swimming of the walrus, I have the following observations to record. If they are lying out in the water, they

first stick the head down, so that only the back is above water; then this slowly disappears under the surface and the hind flippers appear, and then these also go down (without, it may be remarked, the rapid and powerful movement which characterizes e. g. *Phoca foetida*); they now swim for about 10 minutes quite under water, simply by moving their hind flippers; a couple of slow beats from side to side, a short rest while floating, then a couple of beats again and so on. The front flippers are never used in the water but are held close in to the body, and when they come up (with

Fig. 5. A male Walrus plunges into the water at Hvalrosodden. August 1906.

head first) they blow strongly and like to lie some time on the surface before going down again. On the other hand, they naturally use to a great extent all four legs (and also the teeth) when they are climbing up on to the drift-ice or moving over this, just as on land, as I had frequent occasion to observe on Hvalrosodden in August 1906. Here half a score of them were lying asleep together; when we fired on them a tremendous tumult arose, those not killed at once raised themselves up on their front flippers and bellowed loudly; as they pushed off with these, they swung the body round and brought the hind flippers forwards, close in under the body; and while the front flippers supported the animals they slid out into

the water by shuffling alternately forward with the hind flippers and to the side, sometimes with the one front flipper, sometimes with the other. It was astonishing to see the large, clumsy animals moving away so rapidly; in a moment they were out in the water, so that the foam was all over them (see Fig. 5).

The animals naturally go up on to the land or ice to rest themselves and in a short time they fall asleep. They are very drowsy especially after a heavy meal; they stretch themselves, belch and scratch well-pleased their sides and stomach with their flippers (in doing this they move their hind flippers especially with great ease), and roll on their backs to dry their bellies in the sun. When they are sleeping they are not wakened even by the noise of a motor boat, or they merely lift the head and soon lay it down again. If the danger is more pressing it is almost comic to observe how they struggle between their sleepiness and watchfulness; they move their head to smell the direction of the wind, rise up and bellow, but they are unable to suppress a yawn, and the head threatens all the time to fall asleep. Just as the hearing is obviously weak the sight is also apparently weakly developed; they see nothing until one is quite close to them, and if one now and then stands still, they are quite unable to distinguish between a man and a rock, so that we could get to within a couple of steps from a walrus crawling up on land before firing the gun. Things are quite different in the water, on the other hand; even though their powers of seeing and hearing are the same here, their watchfulness is quite different and their movements active; and if wounded they are dangerous about a boat. This refers especially to the males, and just as elsewhere here in North-East Greenland these keep together in herds of up to 10 (when, as already mentioned, the ice does not prevent it), both older and younger animals; while the females are encountered singly, and apparently, much more seldom. These latter have, as known, converging narrow tusks sloped and spatulate at the end (a female of 300 cm. had tusks of 29 and 32 cm. in length, at a distance from one another above of 11 cm., below of 6 cm.), whereas those of the male diverge and are much thicker at the base than at the tip. The hairy covering of old animals tends to be more brownish than in the young animals (in which it is almost green-black)[1], but all the animals shot had marks of the tusks of their comrades, in the form of wounds and scratches in the dense hairy covering, and on their bellies were numerous intercrossing furrows caused by stones on the sea bottom. As evidence

[1] This difference in colour is most evident when the animals are seen from some distance.

of the strength of the walrus, it may be mentioned that an old male, which had been shot and could not move, had yet sufficient strength left to dig its tusks right to the root down into the sand where it lay; and though all the bullets stuck in its head, 18 more were required before it died. At another place (Snenæs (ca. $76^1/_2$° N. L., 19° W. L.) $^{19}/_8$ 06) a wounded walrus had fixed its tusks deep into the frozens now on the land, probably in the endeavour to climb up there. The younger animals we hunted in the water were very shy and endeavoured to get away in on the land, where they went far up on the beach.

Fig. 6. Dead female walrus at Cape Bismarck $^{29}/_8$ 1907. (Note the converging, narrow tusks.)

That the sense of smell is feebly developed I conclude from this, that although half a score of dead animals lay on the beach after the great walrus hunt in August 1906, and gradually became rotten so that an insufferable stench rose from them, yet the remaining animals did not cease to come up on the beach right to their dead comrades — presumably because they imagined that the others lay and slept, as they had done so many nights before in the past years. That the living animals nevertheless had an instinctive feeling, that something was wrong with the dead, appeared from the fact, that when they approached hesitatingly and were quite near to them, they turned back and clambered up the beach at another place.

The food of the walrus mainly consists, as is known, of shell-fish; thus in the North-East Greenland walrus we found the "feet" of *Cardium groenlandicum* (but not the shells); further, in one animal a large *Sclerocrangon boreas*, in another small stones and in a third remains of a seal (*Phoca foetida*) in the form of hind flippers, the skin of the head with a part of the skull etc. ($^{16}/_{9}$ 07). This last kind of food, not elsewhere found in walrus, was probably the remains of a meal of a bear the walrus had found and then eaten for want of better; there can naturally be no talk of the walrus

Fig. 7. Remains of a *Phoca foetida* in the stomach of a walrus. Danmarks Havn $^{16}/_{9}$ 1907.

having killed the seal. With regard to the manner in which the animals obtain their food (which occurs on the sandy bottom in shallow water near the coasts or on banks in the sea), it was observed, that they sink down to the sea-bottom in a sloping direction (the front end downmost), until they almost stand on their heads; they then move backwards ploughing the bottom with their tusks; after a short time they return to the surface to breathe and then again go down (September 1907). Or they may lie for hours (even several days) on an ice-floe near a shell-fish bank out in the fjord, now and then diving down for ca. 10 minutes under the water to return with their mouth full of shell-fish (off Cape Bismarck (76° 42′ N. L., 18° 36′ W. L.), August 1907; the depth here was ca. 70 m.).

The largest male walrus which was measured was 370 cm. All had especially on the mammæ numerous lice (*Haematopinus trichechi*) attached to them (this has not before been observed on the East Greenland walrus).

In conclusion I may note from my journal two observations on the walrus, which I am unable to explain fully but which seem to me specially interesting, as both of them have been unknown hitherto and are very peculiar.

The one observation was made by Captain Koch on the return voyage from Kap Bridgman ($^{6}/_{6}$ 07). At 81° 10′ N. L. there was a large opening with clear water and a stretch of ice about 10 inches thick. On the latter lay a male walrus and close to it a seal (*Phoca foetida*). The walrus lay near a hole in the ice, through which presumably the seal had first come up and afterwards the walrus. When the men approached, both animals moved away in the direction of the open water, but as the walrus moved faster than the seal it quickly overtook the latter, and then the remarkable thing was seen, that it did not go round the seal, but turned on it and shoved at it; and as presumably it did not imagine this sufficient it dug its tusks into the animal lying almost helpless on the ice. When both animals were shot later, the seal was found to be cruelly marked from this rough treatment with bleeding wounds on the body. Whether the reason was, that the walrus had simply become greatly enraged because the seal was in its way, or whether it was a time of year when the walrus is specially brutal towards its rivals (pairing time?), and thus in the absence of these had broken loose on the seal, must remain unanswered.

The second observation was made by myself at Stormkap (ca. $76^{1}/_{2}$° N. L., ca. $18^{1}/_{2}$° W. L.), $^{25}/_{8}$ 07. "The Storm Bugt previously free of ice was to-day filled with drift-ice; yet there were many larger and smaller spaces with open water, near the land covered with thin ice. Here I saw two walrus in the forenoon. Sometimes they were close under the land (so near, that the body was above the surface while swimming), sometimes they swam outward side by side under the thin ice and came up in a clear space further out, one at a time; then they blew and approached one another floating, until they suddenly turned on the side and belly to belly sunk in the water. They reappeared again shortly after, close to one another, turned somersaults and played about in all possible directions, so that it was impossible to distinguish the one body from the other; each time they circled round, their two heads came up together, then they swung round one another, their bodies almost entwined and finally all four hind flippers hung vertically in the

air; then the animals disappeared in the water to rise again in the same way. After $^1/_4$—$^1/_2$ an hour they remained up, but only to swim to another clear space and continue their play. The one sometimes left its (presumable) mate and swam a little round about in the neigbourhood, but quickly returned to the other, which meantime had remained at the same spot floating on the surface, while making peculiar, slow and rhythmic movements. It ducked its head down in the water and up again, blowing and moaning all the time, then bent its back up in an arch, sank again and pushed up its head and so on, just as if it were recovering its balance after powerful efforts. Occasionally they swam far out and moved about where the ice lay denser, but soon returned to the more ice-free water along the land. Only once and only for a moment did they go up on the beach. I watched them continuously for a couple of hours; then they disappeared and at the same time I saw a quantity of drift ice come down with the current and fill up the previously ice-free water. Later in the day however I saw one of them among the drifting ice some distance from the land. It was a day of great sunshine, but with relatively low air temperature."

The probable explanation of the phenomenen can only be that they were pairing; neither of the animals was shot, however, so that their sex could not be determined with certainty.

Bearded Seal (*Phoca barbata*, Fabr.)

This seal which seems to occur in much fewer numbers at North-East Greenland than the others, is not to such a high degree bound to the shallow waters as the walrus. Thus, it has been observed on July 30th 1908 at ca. $75^1/_2$° N. L., ca. 8° W. L. in the scattered, large ice far from land, and 4 days earlier (77° 20′ N. L., 14° 17′ W. L.) two large animals lay on the edge of a large ice-field, where there was much open water (depth ca. 325 m.); lastly, a large *P. barbata* lay on an ice-floe at ca. 76° N. L., ca. 15° W. L. ($^{28}/_7$ 08). Three animals were seen in the clear spaces among the ice in the coastal water east of Store Koldewey (ca. 76° 10′ N. L., ca. 17° W. L., $^{12}/_8$ 08; the depth here was ca. 220 m.); and singly and two together it was occasionally observed in the fjords about Danmarks Havn throughout the whole year (except during quite the dark period), mostly at their holes in the fjord ice and on pieces of drift ice, or at the larger or smaller openings in the thin ice in the autumn. It does not seem to go in on too shallow water (probably because its principal food is fish), except at the mouths of large rivers which contain quantities of salmon (Hvalrosodden).

With regard to its geographical distribution towards the north, there is the peculiarity that it has not been observed north of ca. 77° N. L. nor have its bones been found in Eskimo ruins, when the latter lie north of the latitude mentioned. Comparing this with what was said in the Introduction regarding the northern boundary for the open coastal and fjord water, we may well conclude, that the distribution of the bearded seal is dependent on this. It may quite possibly occur still further north, where the coastal and fjord ice do not hinder the approach of the open Polar Sea to the land (e. g. at ca. 81° N. L.).

With regard to its holes in the ice, these were observed both in thicker and thinner ice in October 1906 and 07. These holes for ascending, which were ca. $^3/_4 \times 1$ m. in diameter and oval in form, had a great resemblance to those described for the walrus (with thrown-up, broken pieces of ice like a wreath round the hole); on thicker ice however the hole was funnel-shaped, broadening out greatly below. On the ice *P. barbata* is very shy; it is almost impossible to approach it without great care, and we can then see it raising itself on its front flippers and move its small head. Yet they also lie and sleep on the ice; they have been observed for 12 hours here. In the water they are less shy, and one may approach nearer to them.

Personally I have never been close to a bearded seal on the Expedition. Those that were shot either escaped through their holes and the clefts in the ice, or fell into the water by some mischance. Regarding their food, sex, length etc., therefore, I have nothing to note.

Harp or Greenland Seal (*Phoca groenlandica*, O. Fabr.).

This seal was not seen with certainty under the coast or in the fjords of North-East Greenland. On the other hand, it is common enough in the outermost parts of the drift ice, and it was also seen here both in 1906 and 1908 ($^{31}/_7$ 06 at 75° N. L., 4° 34′ W. L., where the depth of water was above 2000 m., and $^{30}/_7$ 08 at ca. $75^1/_2$° N. L., ca. 8° W. L.).

That it has also not been living in the fjords formerly, seems clear from the fact, that its bones are nowhere found in the Eskimo ruins.

Fjord Seal (*Phoca foetida*, O. Fabr.).

This is the commonest seal both in the drift ice and in the North-East Greenland fjords. At the first place it was met with singly in the clear spaces between the ice-floes, constantly diving;

and it often remains for a long time at the same spot, regarding with curiosity everything unusual it may come across. In general it is the small seals (the young "troll" seals and a little older animals), which are met with out here; the full-grown animals, which were so common the whole year through in the fjords at Danmarks Havn and several other places were not at all seen out here. They are never found lying on the ice (in contrast to the almost equally common *Cystophora cristata* Erxl.).

The place furthest east where they were found was ca. 76° N. L.,

Fig. 8. Hole for ascending of *Phoca foetida*. Shannon Island 1/4 1908. (The ice is seven months old.)

13° 26′ W. L.; in other words, they do not occur (or in any case only rarely) in the outer parts of the drift ice, but in the middle and inner parts of this (cf. *Phoca groenlandica* and *Cystophora cristata*), as also everywhere on the coasts and in the fjords at North-East Greenland. In the fjords they were observed on innumerable occasions throughout the whole year at all the places where the ice was suitable (see Introduction).

Towards the north it was observed on the ice in the mouth of Hagens and Danmarks Fjords (2/6 and May, July 1907); further at ca. 80°—81 1/2° N. L. (June) in the very open water here; and its bones were common in the Eskimo ruins at 80° 25′ N. L. and every-

where on the outer and fjord coasts, islands etc. at ca. 76°—ca. 78° N. L.

In the summer, when there is open water in the fjords and on the coasts, the fjord seal is seen everywhere here, but singly; and it is evidently very curious, lying for a long time floating with its head above the water or raising itself vertically in this to look around. If they are frightened (for example, by some movement of a man or by a shot), they dive down like lightning, but soon come up again; if they are again frightened, they go down in the water for a longer time.

When the thin ice forms in the autumn, the current still keeps some larger or smaller parts of the fjord ice-free; here the fjord seals remain and can often be seen lying] on the edge of the thin ice (October 1907); when the ice is not too thick, they break through it, and these holes for ascending are almost circular, ca. $^1/_2$ M. in diameter, but otherwise resemble those of the other seals. That these holes are kept open far into the autumn is seen from the fact, that they were found in ca. 1 M. thick fjord ice at the end of October 1906. — At this time breathing holes are also common and become more so as the winter approaches; they are ca. 4 cm. in diameter, and on the thicker ice open out funnel-shaped below; but gradually, as the snow layer increases on the ice, it becomes more occasional to find any evidence of the presence of the fjord seal.

That they also occur in the North-East Greenland fjords in the winter, appears however from the fact, that I found a hole on $^{19}/_3$ 08, which had been dug[1] through the ca. $1^1/_2$ M. deep snow near a large ice berg off the west side of Store Koldewey. "About a meter above the surface of the fjord ice the snow ended and I saw here a spacious cave (there was room for at least 2—3 seals) in the form of a vault, with snow as roof and ice as floor. I dug it out to its fullest extent and found a large hole (85 cm. in diameter) in the middle of the ice-floor, covered by 5 cm. thick, thin ice, under which there was free water. Further down, however, the hole was closed by ice (probably because the fjord ice and the iceberg had changed their relative positions), but was continued by a small crack down in the ice (which was $1^1/_2$—2 M. thick). The cave itself was at places ca. 50 cm., at others ca. 150 cm. high and the whole of the roof (underside of the snow) was covered with small clumps of ice and icicles as with a coating of glass, from the condensed breathing of the seal. I could distinctly see on the edge of the hole, that the animal had used it several times (rings of frozen,

[1] by a bear (*Ursus maritimus*).

disturbed ice and washed-up water), while the surrounding fjord ice was quite flat aud free of snow, and in the one end of the cave there were signs that the seal had often lain there. Perhaps it was a breeding place of the seal, which had had an undisturbed place of retreat until the bear came or the hole closed." At another place (Ile de France) breathing holes were observed in the middle of April 1907.

From the middle of May the seal is common on the coastal and fjord ice. They are extremely shy, 1—3 keeping together; and already when one is far off they shuffle along to their holes and disappear, "springing off" with their hind flippers so that these

Fig. 9. Killed Fjord Seal near Danmarks Havn. June 1907.

show high up in the air. As the summer gradually advances, the fjord ice disappears more and more and the seals now simply "swarm up" through the holes in the melting ice, channels etc. We now see them in larger and smaller herds lying sunning themselves on the ice out in the fjord, and the shimmering, uncertain light doubles their numbers. Most of the seals shot on the Expedition were taken at this season (June—July), when their watchfulness is less and they have plenty of food. When the rivers begin to flow on the land (end of June) they move into these, and can be seen day after day lying on the ice at the mouth of the river, on the watch for the fish which occur there, where the open water is on the increase from day to day. The largest male shot at this time was 170 cm. long

and the largest female 145 cm.; the males have a strong smell of musk. As is well-known, it is mainly this species of seal which serves as food for the polar bear (*Ursus maritimus*), and we often found fragments of skin, claws etc. of *Phoca foetida* in the stomachs of bears; once (21/4 07 at ca. 80° N. L.) the skin of a newly born, young seal; or pieces of bone and the like were left on the ice as reminders that the bears had held a feast there (see also under walrus).

All the seals shot in the drift ice had pelagic Amphipods in their stomachs, both larger yellow and the small white ones, (which are so common at the edge of the drift ice), or only white slime. But they also live naturally on the polar cod (*Gadus saïda*), which is just as common out here as at the coasts and in the fjords, where it is the fjord seal's principal source of nourishment (May—August); we often found the otoliths in their stomachs, which also contained the jaws of the squids, Mysidae and other Crustacea. Only once did we find some small stones in the stomach of a seal 1/7 07); and a *Mya truncata* shell with a piece of a *Strongylocentrotus* was found at a seal hole in October 1907, — in other words, it generally takes its food in the water and not on the bottom, as e. g. the walrus.

Crested seal (*Cystophora cristata*, Erxl.).

This seal has not once been seen on the coast or in the fjords of North-East Greenland. It was only on the voyage in (1906) and out (1908) through the drift ice that it was observed, but there it was extremely common, especially in 1906. It was seen already on the first day we entered the ice, and the first was shot on 31/7 (a young male). Its stomach contained almost undamaged squids and Amphipods, while a second male shot later only had a whitish soup in its stomach. The spot was at 75° 19′ N. L., 4° 42′ W. L. (the depth here was over 2000 M.). On the next day (1/8) two young females were shot at 75° 17′ N. L., 9° 23′ W. L. As we gradually penetrated into the drift ice and this became more and more dense, more and more of the crested seal were seen; as a rule they were lying on ice floes — not specially high but at a steep place from which they could conveniently dive down into the water if disturbed. They were also seen jumping up on to the ice very adroitly or floating slowly away in the open water between the ice-floes. These were mainly the younger animals; yet some very large ones were also seen.

When we came however to the open coastal water on $^{10}/_{8}$ and the land-ice was near, they were no longer seen; here they obviously had their western limit (ca. 76° N. L., ca. 16° W. L., ca. 200 M. depth).

Two years later, when we sailed out through the drift ice, we again met with the crested seals; yet it was remarked, that they were much fewer in number than in 1906, and the reason has probably been, that there was practically no ice on the route of the steamer. They were only seen with certainty at the few places where the ice was most dense; for example, a young specimen with the characteristic dark back and light belly on $^{31}/_{7}$ (ca. $75^{1}/_{2}$° N. L., ca. 8° W. L.).

Bones of this seal have not been found anywhere in the Eskimo ruins along the coasts of North-East Greenland.

Whales (*Cetaceae*).

Greenland Whale (*Balaena mysticetus, L.*).

The Expedition obtained no other evidence of the occurrence of this whale in the waters of North-East Greenland than a piece of the caudal vertebrae, which was found washed up and partially overgrown with moss on the east coast of Store Koldewey on $^{13}/_{8}$ 06 (ca. $76^{1}/_{2}$° N. L., ca. 18° W. L.), as also the bones and wrought instruments of bone, which were found in the Eskimo ruins at the large lake, Sælsøen, behind Hvalrosodden, at Stormbugt, Renskæret (ca. 76° 42′ N. L., 18° 36′ W. L.) and Eskimonæsset (80° 24′ N. L.).

Rorqual (*Balaenoptera sp.*).

The skeleton of an enormous rorqual must at some time, many ages ago, have been stranded on Hvalrosodden, at the time when the land there was in connection with the sea outside, and everywhere around (especially round Sælsøen) we found parts of the skeleton more or less buried in the deposited clay and gravel beds, which had been washed out from earlier glacier rivers (similarly, a separated skull of *Phoca barbata* was also found there). It has not been discovered with certainty in the Eskimo ruins, but as the whalebone, ribs and bones of whales are used for household instruments etc., it would be remarkable if the Eskimos living at that time did not make use of the plentiful material they had such access to at Hvalrosodden — unless, of course, they had died out before the whale was driven in here.

Narwhal (*Monodon monoceros, L.*).

This whale is also known to the Expedition only by bones; a pair of lumbar vertebrae were found on the east side of Store Koldewey on 13/8 06 (at the same place as the caudal vertebrae of *Balaena mysticetus*). Further, its bones and teeth (separated or wrought) were common in the Eskimo ruins on the outer part of Stormbugt, on Renskæret, Syttenkilometernæsset (ca. 77° N. L.), Ile de France and Eskimonæsset.

Caaing Whale (*Globiceps melas,* Traill).

"Atlantic Ocean 68° 7′ N. L., 1° 44′ E. L., 9/8 1908.

At 8 o'clock in the forenoon 10—20 caaing whales approached the ship from the north-east. Already at a long distance off they were readily discovered from the wave they threw out in front every time they came up, and as they went 2—3 at a time, these cross-waves in the water were thus seen at several places at the same time. It was curious to observe how precisely the different animals in each "division" followed one another, both in row and movements. They "shot away" at a great speed, were down for a few minutes, then up again to move a space onwards (so that the whole of the body with exception of the tail was above the water) and then all went down again. They had almost the same size (ca. 5 M.) and were uniformly black; the sides shone from a sea-green shading, and the dorsal fin was fairly small and bent. I could not see the flippers or the white belly, but observed the form of the head and forepart of the trunk and the relative proportions. They passed the ship without stopping and disappeared in the west. Later in the day several of the same kind were seen".

Grampus (*Orca gladiator* Bonaterre).

"Atlantic Ocean 3/8 1908, ca. 73° N. L.

5 whales were seen from the ship to-day. The observer, who knows whales well, was of the opinion, that they were the grampus. They swam along 2 and 3 together and were often seen coming up above the surface."

"A. O. 5/8 1908, ca. 70° N. L., ca. 1° W. L.

I am now quite certain that it was *Orca gladiator* which was seen two days ago. This evening, namely, 5 enormous (ca. 10 M. long) specimens of this whale were seen round the ship and re-

mained some time, so that I had good opportunity to observe them. They "bowed" themselves slowly away through the water; but only rarely was the whole body above the surface (in general only the front part and the dorsal fin); now and then they blew out a jet of steam. I could distinctly see the keels on the sides of the tail and the characteristic white marking (eye-spot and tail-shields); in one or two also there was a weaker or stronger, light (not white) shading (stripe) in the dorsal fin almost at right angles to the longitudinal axis of the body. The form and size of the dorsal fin were very variable; the two extremes here (male and female?) were a very high and sharp form, almost at right angles to the back, and a lower more curved form."

In addition to the above-mentioned seals and whales several others were seen in the seas and fjords, but they could not with certainty be referred to species or genus.

19—11—1910.

III.

DIE ASCIDIEN DER DANMARK EXPEDITION

VON

R. HARTMEYER
(BERLIN)

Die Ausbeute an Ascidien, welche auf der Danmark Expedition von Frits Johansen gemacht wurde, ist zwar an Arten nicht besonderes zahlreich, bietet dafür aber ein um so grösseres tiergeographishes Interesse. Die ostgrönländische Küste war bisher eines der am wenigsten erforschten Gebiete des arktischen Litorals. Es waren nur 4 Arten von dort bekannt. Zwei wurden auf der zweiten deutschen Nordpolfahrt (unter Koldewey) gesammelt und von Kupffer neu beschrieben: *Dendrodoa adolphi* (Kupff.) (Insel Shannon) und *Tethyum kupfferi* Hartmr.[1] (Germaniahafen). Die anderen beiden (von A. M. Rodger gesammelt), *Corella borealis* Traust. und *Phallusia prunum* (Müll.) wurden von mir bestimmt. Sie trugen den Fundort Ost Grönland, 250 Fad., ohne nähere Bezeichnung, sind also offenbar ausserhalb der Küste im tieferen Wasser erbeutet worden. Näheres über diese vier Arten habe ich in der «Fauna arctica» mitgeteilt. Das Sammelgebiet der Danmark-Expedition schliest sich nördlich an dasjenige der Koldewey-Expedition an. Das Material stammt teils von der Winterstation (Danmarks Havn) teils aus dem Øresund und der Stormbugt, beide in nächster Nähe. Die Collection enthält 7 Arten, die, mit Ausnahme von *Phallusia prunum,* sämtlich von der ostgrönländischen Küste noch nicht bekannt waren. Thiergeographisch von besonderem Interesse ist der Nachweis von *Pyura ovifera* von Ost-Grönland. Es befinden sich unter dem Material zahlreiche grosse Exemplare dieser Art, die bisher in ihrer Verbreitung auf West-Grönland, den arctisch amerikanischen Archipel bis herab zur Neu-England Küste und das Beringmeer beschränkt war. In der übrigen Arktis, insbesondere in dem nächstbenachbarten Spitzbergengebiet ist die Art bisher nicht gefunden und dürfte auch angesichts der intensiven Sammelthätigkeit der letzten Jahre kaum noch nach-

[1] Diese von Kupffer irrtümlieh mit der *Ascidia villosa* Fabr. identificierte Art hat von mir den neuen Artnamen *kupfferi* erhalten (vgl. Bronn, Kl. Ordn. Thierr., v. 3 suppl. p. 1360).

gewiesen werden[1]. Deutet das gleichzeitige Vorkommen dieser Art schon auf nahe Beziehungen zwischen Ost- und West-Grönland hin, so kann man aus dem Material auch sonst auf einen faunistisch einheitlichen Character beider Küstenstriche schliessen, wenigstens so weit die Ascidien in Frage kommen. Es handelt sich bei den für Ost-Grönland neu nachgewiesenen Arten in der Mehrzahl der Fälle zwar um circumpolar verbreitete, durch ihre Häufigkeit äusserst characteristische hocharktische Arten, die aber doch in ihrem ganzen Habitus innerhalb ihres Verbreitungsgebietes ihren westgrönländischen Artgenossen am nächsten kommen. Die Exemplare von *Phallusia prunum* erreichen dieselbe bedeutende Grösse, wie diejenigen von West-Grönland. Das gleiche gilt für *Caesira septentrionalis*. *Rhizomolgula ritteri* ist bisher nur von West- und Ost-Grönland bekannt geworden, allerdings besitzt die Art sehr nahe Vervandte in anderen Gebieten der Arktis. Zwar reicht das Material nicht aus, schon jetzt ein einigermassen abschliessendes Urteil über den Character der Ascidienfauna Ost-Grönlands abzugeben. Wir können nur sagen, dass der Gesamteindruck dieser Fauna in hohem Masse auf West-Grönland und die faunistisch dazu gehörige Baffins Bay und Davis Strasse hinweist. Möchlicherweise hat die Besiedelung des nördlichen Teiles dieses Küstenstriches in der Hauptsache vom Westen her um die Nordspitze von Grönland herum stattgefunden. Wie weit alle diese Arten an der Küste nach Süden gehen, wird noch nachzuweisen sein. Im übrigen bildet das Material lediglich eine weitere Stütze für die circumpolare Verbreitung der arktischen Ascidien, auf die ich erst neuerdings mit besonderem Nachdruck wieder hingewiesen habe. Von diesem für die Circumpolarität neuen Thatsachenmaterial interessiert besonders der Nachweis von *Rhizomolgula*, durch den sich der circumpolare Ring auch dieser Gattung immer mehr zu schliessen beginnt.

Die Lebensbedingungen scheinen an diesem Teil der ostgrönländischen Küste für Ascidien sehr günstige zu sein. Das lässt sich nicht nur aus der relativen Grösse der Mehrzahl der Arten, sondern auch aus dem Individuenreichtum einiger derselben schliessen. Bemerkenswert erscheint endlich noch die Thatsache, dass weder die *Botryllidae* noch irgend eine krikobranchiate Art in dem Material enthalten ist. Man möchte fast annehmen, dass dieser Mangel an koloniebildenden Formen, auf den ich früher bereits hinsichtlich des Gebietes im Westen von Grönland hingewiesen habe, weniger ein zufälliges, in der geringeren Grösse dieser Objecte begründetes

[1] Die Angabe Redikorzew's von dem Vorkommen dieser Art in der Kola-Bucht beruht nach einer brieflichen Mitteilung dieses Autor's an mich auf einer Etikettenverwechslung.

Sammelergebnis darstellt, sondern dass es sich, wo nunmehr das Resultat intensiver Sammelthätigkeit auf beschränktem Raume vorliegt, bis zu einem gewissen Grade wenigstens um eine faunistische Eigentümlichkeit dieses ganzen Gebietes handelt.

Fam. **Caesiridae** Hartmr. [*Molgulidae*].

Gen. *Caesira* Flem. [*Molgula*].

Caesira retortiformis (Verr.).

1903 *Molgula retortiformis,* Hartmeyer in: Römer & Schaudinn, Fauna arctica, v. 3 p. 145.

Fundnotiz:

Stat. 63. Stormbugt, 10—20 Fad. 20. VIII. 1907. 1 junges Exemplar.
Stat. 68 a. Øresund, 20—30 Fad. 2. IX. 1907. Hydroidenregion, Felsboden. 1 Exemplar.

Von dieser circumpolar verbreiteten, grössten und häufigsten arktischen Art der Gattung *Caesira* liegen nur zwei jugendliche Stücke vor. Die Gonaden, deren Bau und Lage für diese Art characteristisch ist, sind noch nicht entwickelt, doch kann die Zugehörigkeit der Stücke zu obiger Art auf Grund der übrigen Anatomie nicht zweifelhaft sein. Die Öffnung des Flimmerorgans ist nicht, wie es für *C. retortiformis* die Regel zu sein pflegt, nach rechts gewandt, sondern gleichzeitig ein venig nach hinten gerichtet. Übrigens hat Redikorzew (1908) bei einigen sibirischen Stücken die gleiche Lage beobachtet.

Von Ost-Grönland war die Art bisher nicht bekannt.

Caesira septentrionalis (Traust.).

1903 *Molgula septentrionalis,* Hartmeyer in: Römer & Schaudinn, Fauna arctica, v. 3 p. 152.

Fundnotiz:

Stat. 71. Øresund, 15—20 Fad. 4. IX. 1907. Steine mit Hydroiden, Schalen und Rotalgen. Frits Johansen. 1 Exemplar.

Die Ausbeute enthält ein Exemplar, das alle characteristischen Merkmale dieser Art aufweist. Das Tier ist beträchtlich grösser, als die früher von mir (1903) beschriebenen Exemplare. Die Länge beträgt (am Mantel gemessen) 27 mm, die Höhe 36 mm; am Innenkörper sind die entsprechenden Masse 16 mm und 20 mm. Das Stück übertrifft demnach an Grösse auch noch das Original der

Molgula boreas Traust., die ich als synonym betrachte (l. c. p. 154). Der Körper ist länglich eiförmig, dicht mit kleinen Steinen, Schalentrümmern und andern Fremdkörpern bedeckt, insbesondere im Bereiche des Siphonenfeldes. Die Farbe ist dunkelbräunlich bis schwärzlich. Die Siphonen haben die characteristische Lage. Auch die Anordnung die Muskulatur zeigt das für die Art typische Verhalten. An den Siphonen ist sie besonders entwickelt. Die Lage des Flimmerorgans entspricht meinen früheren Angaben, doch liegt der rechte der beiden nicht spiralig eingerollten Schenkel teilweise innerhalb des linken. Die Falten des Kiemensackes tragen 5 bis 6 innere Längsgefässe; an der dorsalen Seite der Falten bemerkt man die früher erwähnten beiden isolierten inneren Längsgefässe. Die Gonade ist mächtig entwickelt.

Von Ost-Grönland war die Art bisher nicht bekannt.

Gen. *Rhizomolgula* Ritt.

Rhizomolgula ritteri Hartmr.

1903 *Rhizomolgula ritteri,* Hartmeyer in: Römer und Schaudinn, Fauna arctica, v. 3 p. 168.

Fundnotiz:

Stat. 31. Danmarks Havn, 0—5 Fad. 7. X. 1906. Litoral- und Laminarienregion. 2 Exemplare.

Diese interessante kleine Art wurde 1903 von mir als erster bekannt gewordener arktischer Vertreter ihrer Gattung neu beschrieben, nachdem zwei Jahre vorher die Gattung durch Ritter mit dem Typus *R. arenaria* für eine Form von Alaska begründet worden war. Seither sind zwei neue arktische Arten durch Redikorzew beschrieben worden, *R. gigantea* (Sibirisches Eismeer) und *R. warpachowski* (Nowaja Semlja). Die Gattung scheint demnach characteristisch für die Arktis zu sein während sie mit einer Art in den nördlichen Pacific eindringt[1].

Es liegen mir zwei Stücke vor, die ich obiger Art zurechne und die nunmehr auf der West- wie Ostseite von Grönland bekannt ist. Der Körper des einen Exemplars ist amähernd kugelig, der des anderen dagegen mehr herzförmig, gleichzeitig seitlich zusammengedrückt, und am Vorderende abgeflacht. Der Durchmesser beträgt etwa 10 mm. Letzere Körperform giebt Redikorzew für seine beiden Arten an. Doch dürfte auf diesen Character als Artmerkmal ebensowenig besonderer Wert zu legen sein, wie auf die übrigen äusseren Merkmale (Stiellänge, Beschaffenheit der Manteloberfläche), die

[1] Von der von Michaelsen beschriebenen *R. intermedia* mit unsicherem Fundort sehe ich hier ab.

Redikorzew zur Unterscheidung der Arten verwendet. Der Stiel der beiden vorliegenden Stücke ist ganz kurz. Es sind 12 grosse Tentakel vorhanden, daneben aber noch einige kleinere, sodass die Totalzahl etwa 18 beträgt. Wenn Redikorzew in seiner Bestimmungstabelle für *R. ritteri* nur 12 Tentakel angiebt, für *R. gigantea* dagegen 18, so ist das nicht ganz correct, da ich (l. c. p. 169) die Totalzahl ebenfalls auf ca. 18 angebe, nur die der grossen auf 12. Die Öffnung des Flimmerorgans ist, entsprechend meiner früheren Angabe, nach vorn und gleichzeitig etwas nach links gewandt, während sie bei Redikorzew's beiden Arten nur nach vorn gewandt ist. Die Zahl der inneren Längsgefässe auf den Falten entspricht ebenfalls meinem früheren Befunde, nähmlich 5 auf jeder Falte, davon 2 auf der ventralen, 2 auf der dorsalen Seite, eins auf der Firste. An der Zugehörigheit unserer Stücke zu *R. ritteri* kann demnach wohl kein Zweifel bestehen, aber auch die beiden anderen arktischen Arten, insbesondere *R. gigantea*, scheinen mir sehr nahe verwandt zu sein.

Von Ost-Grönland war die Art bisher nicht bekannt.

Fam. **Pyuridae** Hartmr. [*Halocynthiidae* s. *Cynthiidae*].

Gen. *Pyura* Mol. [*Halocynthia* s. *Cynthia* + *Boltenia*].

Pyura [*Boltenia*] *ovifera* (L).

1903 *Boltenia ovifera*, Hartmeyer in: Römer & Schaudinn, Fauna arctica, v. 3 p. 173.

Fundnotiz:

Stat. 63. Stormbugt, 10—20 Fad. 21. VIII. 1907. Delesseriaregion, Felsboden. 1 junges Exemplar.

Stat. 66. Stormbugt, 15—20 Fad. 28. VIII. 1907. Dellesseriaregion, Felsboden. 1 Exemplar.

Stat. 68 a. Øresund, 20—30 Fad. 2. IX. 1907. Hydroidenregion, Felsboden. 8 erwachsene, 2 junge Exemplare.

Stat. 95. Danmarks Havn, 25—50 Fad. 19. VII. 1908. Frits Johansen. 2 junge Exemplare.

Von dieser Art liegt mir eine grössere Anzahl erwachsener, stattlicher Exemplare vor, die in ihrer Totallänge den Stücken von der Westseite Grönlands und von Neu Fundland (l. c. p. 177) nicht nur gleich kommen, sondern sie im Durchschnitt sogar übertreffen. Ausserdem enthält die Collection noch mehrere jugendliche Exemplare. Ich setze die Masse einiger ostgrönländischer Stücke hierher.

	Totallänge:	Körperlänge:	Stiellänge:
erwachsene Tiere	34,5 cm.	7,5 cm.	27 cm.
	33 —	8 —	25 —
	31,3 —	6,8 —	24,5 —
	30,8 —	7,3 —	23,5 —
	30 —	7 —	23 —
	25,5 —	6 —	19,5 —
junge Tiere	12,2 —	2,2 —	10 —
	9,2 —	1,5 —	7,7 —
	7,5 —	1 —	6,5 —
	4,7 —	1,2 —	3,5 —

Vergleicht man diese Tabelle mit meiner früher gegebenen (l. c. p. 177), so ergeben sich einige immerhin bemerkenswerte Unterschiede. Zunächst sei festgestellt, dass die Totallänge des grössten Tieres auf beiden Tabellen genau die gleiche ist. Dagegen beträgt die Totallänge fast aller ostgrönländischen Stücke 30 cm. und mehr, während sie auf der früheren Tabelle mit der einzigen obigen Ausnahme weniger als 30 cm. beträgt. Vergleicht man aber das Verhältnis von Körper und Stiel auf beiden Tabellen, so ergiebt sich, dass die Länge des Stieles im Vergleich zur Länge des Körpers bei den ostgrönländischen bedeutend grösserist, als bei den westgrönländischen und Neu Fundland Stücken. Während bei letzeren der Körper eine Länge bis zu 9,5 cm. erreichte, der Stiel dagegen nur in einem Falle die Länge von 20 cm. überschritt, beträgt die Stiellänge bei fast allen ostgrönländischen Stücken mehr als 20 cm., steigt in einem Falle sogar bis auf 27 cm., während der Körper nicht mehr als 8 cm. Länge erreicht. Das Stück mit dem 27 cm. langen Stiel hat sogar nur einen 7,5 cm. langen Köper. Durchweg zeichnen sich also die ostgrönländischen Stücke durch einen im Verhältnis zur Körperlänge sehr langen Stiel aus. Bei den grossen Exemplaren erreicht der Stiel mehr als das Dreifache, in manchen Fällen fast das Vierfache, bei den jungen Tieren sogar das Fünf- bis Sechsfache der Körperlänge. Dabei ist zu berücksichtigen, dass die Stiele sämtlicher Exemplare (mit Ausnahme desjenigen von 33 cm. Länge) über der Anheftungsstelle abgebrochen waren. Wie weit oberhalb, lässt sich natürlich nicht feststellen, aber selbst wenn es ganz nahe derselben wäre, wie aus dem geringen Durchmesser des abgebrochenen Stielendes wohl geschlossen werden darf, so würden die Zahlen der Stiel- und Totallänge sich noch etwas erhöhen und das Längeverhältnis von Stiel und Körper zu einander sich noch mehr zu Ungunsten des letzeren verschieben. Man darf demnach sagen,

dass die Maximallänge dieser Art mit 34,5 cm. noch nicht erreicht ist.

Sämtliche grossen Exemplare zeichnen sich durch eine im allgemeinen sehr wenig gerunzelte oder fast glatte Oberfläche aus. Nur zwischen und im Umkreis der Körperöffnungen (vermutlich auch nur eine Folge postmortaler Contraction) ist eine etwas stärkere Runzelung zu bemerken. Sie gleichen darin dem von mir früher abgebildeten Stück von Neu Fundland (l. c. t. 4 f. 11). Exemplare mit tiefen Längsfurchen und Wülsten, wie eins in f. 12 abgebildet ist, fehlen unter dem Material. Der äusseren Form nach gehören die Stücke zur *f. ovifera* und *f. reniformis*. Die *f. fusiformis* ist nicht dabei. Der Körper der jungen Exemplare ist ausgesprochen nierenförmig, die Oberfläche ist nur leicht gerunzelt, von einem Cilienbesatz (l. c. p. 178) ist dagegen keine Spur mehr zu bemerken. Die Farbe des Körpers der grossen Tiere ist milchweiss, der Stiel ist hellbräunlich.

Von Ost-Grönland war die Art bisher nicht bekannt. Auf die tiergeographische Bedeutung dieses Nachweises wurde schon hingewiesen.

Pyura [*Cynthia*] *echinata* (L.).

1903 *Halocynthia arctica,* Hartmeyer in: Römer & Schaudinn, Fauna arctica, v. 3 p. 190.

Fundnotiz:

Stat. 61. Stormbugt, 10—15 Fad. 7. VIII. 1907. Steine, Schalen, Delesseria. Frits Johansen. 1 grosses Exemplar an Kalkalgen.

Stat. 63. Stormbugt, 10—20 Fad. 21. VIII. 1907. Delesseriaregion, Felsboden. 8 Exemplare, darunter ein junges.

Ohne nähere Fundortsangabe. 9 Exemplare.

Die Synonymie dieser Art habe ich in einer neuerlichen Arbeit behandelt mit dem Ergebnis, dass ich die Zugehörigkeit der subarktischen "*echinata*" zur Gattung *Pyura* zweifelfrei nachgewiesen und die früher von mir als besondere Art abgetrennte hocharktische *arctica* wieder mit ihr vereinigt habe. Wegen weiterer Einzelheiten muss ich auf die betreffende Arbeit verweisen.

Die vorliegenden Exemplare geben keinen Anlass zu irgend welchen Bemerkungen. Sie erreichen die stattliche Grösse, die von den hocharktischen Individuen bekannt ist, während bei dem jugendlichen Tier die Mantelstacheln durchaus nach dem sogenannten arktischen Typus gebaut sind.

Von Ost-Grönland war die Art bisher nicht bekannt.

Fam. **Tethyidae** Hartmr. [*Styelidae*].

Gen. *Tethyum* Boh. [*Styela*].

Tethyum rusticum (L.).

1903 *Styela rustica*, Hartmeyer in: Römer & Schaudinn, Fauna arctica, v. 3 p. 217.

Fundnotiz:

Stat. 63. Stormbugt, 10—20 Fad. 21. VIII. 1907. Delesseriaregion, Felsboden. 8 Exemplare, darunter 1 junges.

Stat 67. Danmarks Havn, 10—15 Fad. 29. VIII. 1907. Delesseriaregion, Felsboden. 1 Exemplar.

Stat. 68 a. Øresund, 20—30 Fad. 2. IX. 1907. Hydroidenregion, Felsboden. 1 junges Exemplar.

Stat. 70. Danmarks Havn, 10—15 Fad. 4. IX. 1907. Delesseriaregion, Schlammboden. 1 Exemplar.

Stat. 71 a. Øresund, 15—20 Fad. 4. IX. 1907. 1 Exemplar.

Das Material giebt keinen Anlass zu weiteren Bemerkungen. Es befinden sich jugendliche und grössere Exemplare (bis 5 cm.) darunter. Ein Teil der Exemplare (auch grössere) ist hornlos. Die Oberfläche ist ziemlich glatt, nur wenig gerunzelt. Die Tiere sind an Balaniden und Schalen angewachsen; ein grosses Exemplar ist basal mit 2 Exemplaren von *Phallusia prunum* verwachsen und dicht mit Delesserien bedeckt.

Von Ost-Grönland war die Art bisher nicht bekannt.

Fam. **Phallusiidae** Traust. [*Ascidiidae*].

Gen. *Phallusia* Sav. [*Ascidia*].

Phallusia prunum (Müll.).

1903 *Ascidia prunum*, Hartmeyer in: Römer und Schaudinn, Fauna arctica, v. 3 p. 285.

Fundnotiz:

Stat. 16 b. Danmarks Havn, 5 Fad. 17. VIII. 1906. Laminarien, Schlammboden. 4 Exemplare.

Stat. 20 a. Danmarks Havn, 5—10 Fad. 19. IX. 1906. Delesseriaregion, Felsboden. Frits Johansen. 1 Exemplar.

Stat 32. Danmarks Havn, 6 Fad. 8. X. 1906. Schlick mit Steinen und Rotalgen. 2 Exemplare.

Stat. 48. Danmarks Havn, 3—6 Fad. 18. VII. 1907. Laminarien, Schlammboden. 3 junge Exemplare.

Stat. 57 a. Danmarks Havn, 8—10 Fad. 8. VIII. 1907. Delesseriaregion, Felsboden. Viele jugendliche und ganz junge Exemplare.

Stat. 61. Stormbugt, 10—15 Fad. 7. VIII. 1907. Steine, Schalen, Delesseria. Frits Johansen. 7 Exemplare.

Stat. 63. Stormbugt, 10—20 Fad. 21. VIII. 1907. Delesseriaregion, Felsboden. Sehr viele Exemplare.

Stat. 65. Danmarks Havn, 5—10 Fad. 25. VIII. 1907. Laminarien und Delesserien, Schlammboden. 1 junges Exemplar.

Stat. 67. Danmarks Havn, 10—15 Fad. 29. VIII. 1907. Delesseriaregion, Felsboden. 2 Exemplare.

Stat. 68 a. Øresund, 20—30 Fad. 2. IX. 1907. Hydroidenregion, Felsboden. 4 junge Exemplare.

Stat. 71. Øresund, 15—20 Fad. 4. IX. 1907. Steine mit Hydroiden, Schalen und Rotalgen. Frits Johansen. 4 Exemplare.

Stat. 71 a. Øresund, 15—20 Fad. 4. IX. 1907. Delesserien- und Hydroidenzone, Felsboden. 2 Exemplare.

Stat. 72. Danmarks Havn, 10—20 Fad. 9. IX. 1907. Frits Johansen. 4 Exemplare.

Stat. 72. Danmarks Havn, 5—8 Fad. 12. IX. 1907. Laminarienregion, Schlammboden. 2 Exemplare.

Von dieser Art liegen zahlreiche Exemplare in allen Grössen- und Altersstadien vor, die in ihren äusserlichen Merkmalen einen nicht unbeträchtlichen Grad von Variabilität zeigen. Die grössten Exemplare kommen denen von West-Grönland gleich (90 mm lang, 60 mm hoch) und erinneren in ihrem ganzen Habitus sehr an die von Traustedt als *Phallusia olriki* von dort beschriebenen Stücke. Der Mantel eines dieser grossen Tiere erreicht an der Basis eine Dicke von 1 cm. Die Tiere sind an Steinen, Kalkalgen, Balaniden oder Laminarien festgewachsen, manche auch basal mit Artgenossen oder mit Exemplaren von *Tethyum rusticum* verschmolzen. Verschiedene sind mit Delesserien mehr oder weniger dicht bedeckt. Bei einigen auf Laminarien festsitzenden kleinen und mittelgrossen Exemplaren ist der Cellulosemantel hellgelblich durchscheinend und die Oberfläche ist mit kleinen kegelförmigen Fortstäzen bedeckt, wie sie für diese Art ungewöhnlich sind. Die Tiere erinnern äusserlich dadurch in gewisser Weise an grosse Exemplare von *Ascidiella aspersa*. Bei mehreren Stücken fand sich an der Basis der Siphonen rotes Pigment.

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19—11—1920.

IV.

REPORT ON THE ECHINODERMS COLLECTED BY THE DANMARK-EXPEDITION AT NORTH-EAST GREENLAND

BY

DR. TH. MORTENSEN

1910

The collection of Echinoderms brought home by the Danmark-Expedition, though it contains no new species or upon the whole any great number of species, is, however, of considerable interest in several respects.

Through the researches of later years, among which those carried out by Mr. James Grieg take a very prominent part, it has been proved that several of those Echinoderms which were hitherto recorded as occurring in the whole of the northern Atlantic, are not really so widely distributed, the specimens from the cold region of the Northern Sea being different from those inhabiting the warm area, specifically or as varieties only, but distinct enough, so that they should not be confounded as one and the same species, inhabiting both the cold and the warm region. For this question the present collection of Echinoderms is of considerable value. Further it has given rise to additional knowledge of several species—especially the rich material of *Hathrometra* (*Antedon*) *prolixa* proved of great importance; the closer examination of these specimens revealed the fact that their Pentacrinoid-larvæ are attached to the cirri of the parents. A good series of developmental stages of these larvæ was found; the description of these beautiful and very interesting larvæ may well be considered the most important part of this report.

Finally the present collection is of considerable value for the study of the zoogeographical distribution of the Echinoderms of Greenland. The Echinoderms of West Greenland have for a long time been comparatively well known; through the Expedition of the "Alert" and "Discovery" (Sir George N. Nares), 1875—1876, those from the northern Part of the West Coast (from 79° 20′ N. lat. to 82° 87′ N. lat.) were made known (described by Duncan and Sladen in „A memoir on the Echinodermata of the Arctic Sea to the West of Greenland", 1881). The Amdrup Expedition, together with several other Expeditions (Ryder, Kolthoff) brought to light the Echinoderm-fauna of the East Coast, from Angmagsalik to about the 74° N. lat. The dredgings of the Danmark Expedition further North, at 75°—78° N. lat., in some way fill the gap, as it may be concluded

with rather great certainty that the North coast, from the tracts examined by the Danmark Expedition to those examined by the Nares Expedition, will not differ essentially in regard to its Echinoderm-fauna from that of these two places. The zoogeographical relations of the Echinoderm-fauna of Greenland can thus be taken up now for a more detailed discussion.

The total number of species of Echinoderms brought home by the Expedition is 26, viz. 2 Crinoids, 12 Asteroids, 8 Ophiuroids, 1 Echinoid and 3 Holothurians. They are the following:

Crinoidea.

1. *Heliometra glacialis* (Leach)
2. *Hathrometra prolixa* (Sladen)

Asteroidea.

3. *Bathybiaster vexillifer* (Wyv. Thomson.)
4. *Pontaster tenuispinus* (Düb. Kor.)
5. *Ctenodiscus crispatus* (Retz.)
6. *Poraniomorpha tumida* (Stuxb.)
7. *Cribrella sanguinolenta* (O. F. Müll.)
8. *Pteraster militaris* (O. F. Müll.)
9. — *pulvillus* M. Sars.
10. *Solaster glacialis* Dan. Kor.
11. — *papposus* (L.)
12. *Pedicellaster palæocrystallus* Sladen.
13. *Stichaster albulus* (Stimps.)
14. *Asterias panopla* Stuxb.

Ophiuroidea.

15. *Ophiopleura borealis* Dan. Kor.
16. *Ophioglypha robusta* (Ayr.)
17. *Ophiocten sericeum* (Forb.)
18. *Ophiopus arcticus* Ljungm.
19. *Amphiura Sundevalli* (M. Tr.)
20. *Ophiacantha bidentata* (Retz.)
21. *Ophioscolex glacialis* (M. Tr.)
22. *Gorgonocephalus eucnemis* (M. Tr.)

Echinoidea.

23. *Strongylocentrotus drøbachiensis* (O. F. Müll.)

Holothurioidea.

24. *Myriotrochus Rinkii* Stp.
25. *Cucumaria frondosa* (Gunn.)
26. *Phyllophorus pellucidus*, Var. *Barthii* (Troschel).

It is unfortunate that no Echinoderm-larvæ have been caught by the Expedition. Owing to the small number of species occurring there it would have been possible to refer almost any larva to its parent species, the more so, as several of the species might be eliminated as having non-pelagic larvæ, which may be concluded from the large size of their eggs, even if their development is not known (e. g. *Ctenodiscus crispatus, Ophiacantha bidentata*). That the plankton samples collected do not contain any Echinoderm-larvæ is by no means a proof that none of the Echinoderms occurring here have pelagic larvæ. Thus *Strongylocentrotus drøbachiensis* is known to have pelagic larvæ, and it may be supposed with rather great certainty that also some of the Ophiurids have pelagic larvæ; some of the Asteroids might well be supposed to have such also.

Crinoidea.

1. **Heliometra glacialis** (Leach).

(Plate X, Fig. 1).

Alecto Eschrichtii Müller.[1] Lütken. 1857. Oversigt over Grønlands Echinodermata. p. 55.

Antedon Eschrichtii Duncan & Sladen. 1881. A Memoir on the Echinodermata of the Arctic Sea to the West of Greenland. p. 73. Pl. VI. Figs. 1—4.

— — P. H. Carpenter. 1888. The Comatulæ. "Challenger" Reports. Vol. XXVI. p. 138. Pl. I. Figs. 8a—d. Pl. XXIV. Figs. 4—14. p. 154.

— — Th. Mortensen. 1903. Echinoderms from East Greenland. Medd. om Grønland. Vol. XXIX. p. 65—66. Pl. I. Figs. 4—6.

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— — J. Grieg. 1903. Echinodermen von dem norwegischen Fischereidampfer "Michael Sars" in den Jahren 1900—1903 gesammelt. II. Crinoidea. p. 13. Bergens Mus. Årb. 1903.

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— — F. Fischer. 1886. Echinodermen von Jan Mayen. Die Østerreichische Polarstation Jan Mayen. Beobachtungs-Ergebnisse. Bd. III. p. 31.

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Heliometra — A. H. Clark. 1907. New genera of recent free Crinoids. Smiths. Miscell. Coll. Vol. 50. p. 350.

— *glacialis* (Leach). A. H. Clark. 1908. Some points in the ecology of recent Crinoids. American Naturalist. XLII. p. 719.

[1] In this paper the literary references are not intended to be complete. Generally only such works are quoted in which remarks on the morphology of the species in question are given.

Heliometra glacialis (Leach). A. H. Clark. 1909. On a collection of Crinoids from the Zoological museum of Copenhagen. Vid. Medd. Nat. Foren. p. 188.

Station 63. Stormbugt; 18—37 m. 1 badly preserved specimen.
— 99. (77° N. 18½° W.) 304 - 1 — — —

Some notes on the Pentacrinoid of this species, with a figure (Pl. X. 1) are given on p. 349—350.

2. Hathrometra prolixa (Sladen).

Pl. VIII.—IX. Pl. X. Fig. 2. Pl. XI. Figs. 1—6. Pl. XII. Figs. 1—5, 7.

Antedon prolixa Sladen. 1881. Memoir Ech. Arctic Sea. p. 77. Pl. VI. Figs. 7—10.
— — Michailovskij. 1903. Echinodermen. Spitzbergen. p. 42, 76.
— — Th. Mortensen. 1903. Echinoderms from East Greenland. p. 65. Pl. I. Figs. 1—3.
— — Grieg. 1903. Echinodermen v. "Michael Sars". Crinoidea. p. 20.
— — Döderlein. 1905. Arktische Crinoiden. Fauna Arct. IV. p. 401.
— — R. Koehler. 1909. Campagnes scientif. Monaco. Fasc. XXXIV. Échinodermes. p. 270. Pl. XXXII, Fig. 11.

Hathrometra prolixa A. H. Clark. 1908. New genera of unstalked Crinoids. Proc. Biol. Soc. Washington. XXI. p. 130.

Station 99. (77° N. 18½° W.) 304 m (22. VII. 1908). Several specimens, some of them excellently preserved.
— 104. (76° 6′ N. 13° 26′ W.) 200—250 m. (Clay with some gravel and shells). 3 poorly preserved specimens.

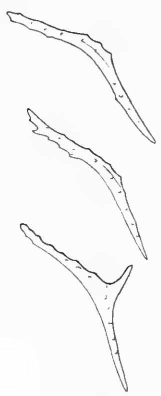


Fig. 1. "Adambulacral" plates of Hathrometra prolixa. 110/1.

In the "Echinoderms from East Greenland" the terminal joints of the pinnulæ of this species are described and figured (Pl. I. 2) as smooth and cylindrical. In some of the present specimens they are, however, somewhat thorny. The "adambulacral" plates are figured as slender, smooth rods, with a small terminal widening; in the specimens from Stat. 104 they are of the same shape, but in all the specimens from Stat. 99 they are more or less thorny, without the terminal widening (Fig. 1). Being somewhat in doubt whether these specimens were really identical with those described in the paper quoted, and as I had not sufficient material for a more detailed comparative study of the different species of the genus *Hathrometra* so as to be able to form a

well-founded opinion of the specific value of the different characters, I sent the material to Dr. A. H. Clark, Washington, the eminent specialist on recent Crinoids, asking his opinion of the matter. He most kindly informed me that after a very careful study he had come to the result that all the specimens were true *H. prolixa*, the characters of the pinnule joints and the "adambulacral" plates being not accompanied by other distinguishing features and thus insufficient for founding upon them a separate species. — Though I do not, of course, in any way doubt the correctness of this result, I would suggest that it might be adventageous to take account of which type of "adambulacral" plates is found in the specimens under examination of this species.

A curious abnormality was found in one specimen, viz. a dichotomously branched pinnule (Pl. XII. Figs. 1, 7); the dichotomy takes place at the third joint.

The species was figured by Duncan & Sladen (Op. cit. Pl. VI. Fig. 7), but evidently from a rather poor specimen, and the figure itself is not very elaborate. Recently Koehler (Op. cit.) has given a figure of a specimen without arms, but with the cirri well preserved. A good representation of the species has, however, not been given as yet. Accordingly I have thought it desirable to give here photographic figures of a pair of the best specimens in hand (Pl. VIII.). They show very well the excessive length of the outer cirri. In the specimen figured from the oral side the hydropores are distinct; they are, however, too small to show in the figure. They are disposed in a rather broad belt in each interambulacral space, along the ambulacral furrow, though somewhat distant from it in the inner part. In the specimen figured (Pl. VIII., Fig. 2) I counted ca. 90 pores in each interbrachial space.

The colour of the living specimens is thus described by Mr. Fr. Johansen, the Zoologist of the Expedition: "Pinnulæ, with the genital organs, yellow red; arms brown-yellow, disk ("anal area") light brown, cirri white".

All the specimens were carefully examined for *Myzostoma*, the result being that in one specimen one was found in the mouth of the host, while in another specimen two *Myzostoma* occurred, one on the disk, the other at the base of one of the arms, close to the ambulacral furrow. In the rest of the specimens no *Myzostoma* were found. — Probably they belong to the species *Myzostoma Carpenteri* v. Graff, hitherto known from the nearly related species *Hathrometra tenella* (Retz.) and *dentata* (Say). The largest of the three specimens is only 0·6 mm long, while *M. Carpenteri* otherwise reaches a size of more than 4 mm length (4·25 mm, according to F. Nansen: Bidrag

til Myzostomernes Anatomi og Histologi. 1885. p. 7). On the evidence of the present scarce material it is, of course, impossible to decide, whether this small size is the normal for the form infesting *H. prolixa*, or whether they are only young specimens. In case they are really fullgrown, they will evidently form a separate species. I notice as a difference from the typical form of *M. Carpenteri*, as described and figured by Nansen (Op. cit., p. 7, Pl. I., figs. 6—7), that dorsal ridges are not distinct. For the rest the shape of the animal is in rather close accordance with the figures given by Nansen, whereas the figures given by v. Graff in his work on the "Challenger" Myzostomida (Scient. Res. of the Voyage of H. M. S. "Challenger", XXVII., 1884, Pl. II., Figs. 10—15) are not so very similar.

While thus the disk and the arms of *H. prolixa* are very clean and free from foreign organisms, the case is quite different with the cirri. Quite a number of different animals may be found attached to them. One of the commonest forms is *Truncatulina lobatula* Walker & Jac., a Foraminifer characteristic through "the tendency displayed by adherent specimens to form for themselves a covering of loosely agglutinated sand" (Brady: "Challenger" Foraminifera, p. 660), a feature well shown by the present specimens. P. H. Carpenter has already recorded this species from the cirri of arctic Comatulids, without naming the species, on which it was found. (Stalked Crinoids. "Challenger", p. 134). Further, several small Hydroids of the species *Lafoea fruticosa* (Sars), *Calycella syringa* L., *Cuspidella* sp. and *Stegopoma fastigiatum* Alder [1]; a serpulid, egg capsules, young colonies of the Bryozoan *Gemellaria loricata* and finally an entoprocte Bryozoan, *Loxosoma*, probably representing a new species, which I hope to have occasion to describe later on.

Considerably more important and interesting is, however, the fact that on the cirri of this species are found Pentacrinoid-larvæ, which are evidently its own brood, as might be concluded alone from the fact that this species was quite dominating on the locality (Stat. 99), only a single specimen of *Heliometra glacialis* being found together with the numerous specimens of *H. prolixa*. Furthermore the Pentacrinoid of *H. glacialis* (described by Levinsen, Karahavets Echinodermata, p. 414—15, Tab. XXXV., Fig. 8) differs considerably from it in several features. It may thus be regarded as an established fact that it is the larva of *Hathrometra prolixa*. A good series of developmental stages is represented. They are in several regards of considerable interest, and it has thus been thought desirable to give a full account of the different stages, the more so as the postembryonal development of Crinoid larvæ has been studied more clo-

[1] I am indebted to Mr. P. Kramp for the identification of these Hydroids.

sely only in a pair of species, viz. *Antedon rosacea* (*bifida*) (by W. B. Carpenter, Bury, Seeliger a. o.) and *Hathrometra Sarsii* (by M. Sars).

The larvæ generally occur on the long marginal cirri, as shown in Pl. VIII, Fig. 3, but sometimes specimens were also found on the inner, short cirri. Generally they were found on about the middle of the cirrus, sometimes occurring two together.

The youngest specimen is only 1·4 mm long, the stalk being 1 mm, the calyx 0·4 mm (Pl. XI, Fig. 1). There are ca. 10 stalk-joints (some of the lower ones could not be distinguished with certainty); the middle ones are the longest, 0·15 mm long, 0·05 mm wide, with the primary ring very distinct and somewhat prominent. The basal disk simple, round.

In another specimen of 2·5 mm length (the stalk 2 mm, the calyx 0·5 mm) the stalk has 15 joints; the three upper ones are quite short, but not broader than those below; in the 4th joint the part below the primary ring is somewhat elongated, the upper part still remaining short. The following joints are elongated, quite cylindrical, but with distinct primary ring; the longest joint is 0·25 mm long, 0·05 mm thick; the 3—4 lower ones are somewhat shorter. The basal disk is small, slightly lobed.

These two specimens, as well as several other specimens of nearly the same size are all in the same stage of development regarding the calyx, which I am designating as the stage I, in accordance with Sars (as also the following stages are designated in accordance with Sars), the calyx consisting only of the basalia and the oralia, with no trace of the radialia (Pl. IX, Fig. 1).

The shape of the basalia is simply trapezoidal, with straight edges, the upper edge being finely undulated, corresponding to the lower edge of the oralia; the outer surface is slightly convex. They afford a structural feature of some interest. As is seen in the figure (Pl. IX, Fig. 1) the lower part consists of an irregular meshwork, while the upper part is quite regular in structure, the holes being arranged in straight lines. This indicates that the lower part represents the plate in its original size, the regular upper part representing additional growth; that this is the correct explanation is evident from the fact that the regular upper part becomes longer with age (Comp. Pl. IX, Figs. 1, 2 and 4). The same feature is observed on the oralia.

The shape of the oralia is very characteristic. They are triangular, with the side-edges and the apex turned outwards, so as to be distinctly concave in the upper part (Pl. IX, Fig. 1; Pl. XI, Fig. 5, see also the figures of the following stages). Along the lower edge a narrow belt of regularly arranged holes, the growth-zone, has appeared; it is distinctly smaller than that of the basalia.

The peculiar shape of the oralia would appear to be a character of specific value; in the Pentacrinoid of *Hathrometra Sarsii* they are described by M. Sars (Mémoires pour servir à la connaissance des Crinoïdes vivants, 1869, p. 48) as being convex, with only the point „garni de très petites pointes coniques proéminentes“; in the figures no trace of any concavity of the orals is seen. On the other hand I find the oralia of the same shape, with the side-edges and apex turned outwards, in the Pentacrinoid of *Hathrometra tenella* (of which Mr. Grieg, Bergen, has most kindly lent me a few specimens for examination — and *H. tenella* is regarded as synonymous with *H. Sarsii* by Grieg), *Heliometra glacialis* and *Antedon petasus*, as also I find a slight indication thereof in some Pentacrinoids of *Antedon mediterranea*, for which I am indebted to Dr. H. C. Chadwick. W. B. Carpenter likewise describes and figures the oralia in the species studied by him as somewhat concave, though not so much as in this species. It is then not improbable that this shape of the oralia will prove to be the rule among the Pentacrinoids of free Crinoids, and one can scarcely help suggesting that it likewise holds good for *Hathrometra Sarsii*, though it is hard to understand, how so conspicuous a feature has been overlooked by so eminent an observer as M. Sars. The peculiar shape of the oralia in these Pentacrinoids reminds one of those of *Hyocrinus* (comp. P. H. Carpenter. Stalked Crinoids of the Challenger. Pl. VI).

Infrabasalia do not appear to exist in this species. Anything recalling the figures 52—53, Pl. 47 of Bury's Memoir on "The early stages in the Development of Antedon rosacea" (Philos. Transact. Vol. 179, 1888) is not to be seen. I have also carefully isolated the plates of the calyx under the microscope by applying cautiously Eau de Javelle in alcohol, so that I am sure no small plates have escaped my notice; but no trace of infrabasalia was found. If they are represented at all in this species, which does not seem probable, they must then already in this stage have been resorbed. A coalescence with the upper stalk-joint is excluded, since a considerable number of joints are yet to appear between the calyx and the uppermost joint of this stage.

It should also be pointed out that in this stage the sacculi have made their first appearance, viz. one in each radius, as seen in Pl. IX, Fig. 1.

The Stage II of Sars, comprising the development of the radialia I—III, I have subdivided in II a, distinguished by the appearance of Radialia I, and II b, in which also Radialia II—III have appeared.

Stage II a. This stage, characterized through the radialia I having appeared, is represented by 3 specimens found attached, one to the

9th joint of a cirrus the two others to the 18th joint of another cirrus, while a fourth specimen was found loose. These specimens are ca. 6—8 mm long, viz. the stalk ca. 5—7 mm, the calyx ca. 0·7—0·8 mm long. The number of the stalk joints is 22—24. The shape of the middle joints is still quite cylindrical, the primary ring remaining distinct, but scarcely prominent. The longest joints, the 8th—14th, are 0·5 mm long, 0·05 mm wide. The lower joints are somewhat shorter, the 3—4 upper ones, as usual, quite short, but scarcely wider than the rest. The basal disk is distinctly lobed (Pl. XI, Fig. 2).

The calyx shows the important difference from the former stage that the radialia (I) have appeared (Pl. IX, Fig. 2). In the stage represented in the figure quoted they are still very small, rhomboidal, lying at the place where the corners of the oralia and basalia meet, these corners being truncated in order to make place for the radial plate. The basalia have grown considerably at their upper end, the oralia somewhat along their lower edge, though not so much as the basalia; on the other hand, it is evident that also the outwards turned edges of the oralia have increased in size, as is seen both from the direct comparison with those of the previous stage and through the fact that a border of regular calcareous meshwork is lining them.

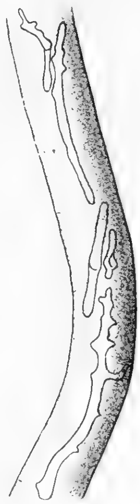


Fig. 2. Part of a tentacle with the spicules in natural position. 275/1

One of the specimens is preserved with the orals opened and the oral tentacles extended (Pl. IX, Fig. 2). It shows that the first sacculus developed is placed on the primary tentacle, the middle one of those three found in each ray. The tentacles contain some irregular, elongated calcareous rods (Fig. 2). The tentacles are beset with the usual sensory papillæ; they are not represented here, because in the specimens mounted in balsam, from which the drawings were made, they were invisible.

One of the four specimens, slightly larger than the three others, is intermediate between stages II a and II b, the radialia I having grown somewhat, and the radialia II have just appeared at their upper end (Pl. XII, Fig. 5). Also the anal plate is developed.

Stage II b. In this stage the Radialia II and III (the axillary) are developed. It is represented by 2 specimens attached to cirri (to the 15th and 17th joint) and 1 loose specimen. The two complete specimens are 8·5 mm long, the calyx being 0·7—0·8 mm long. The number of stalk joints is 25; the longest joints are 0·5 mm long, 0·06—0·07 mm wide; they have thus become somewhat thicker, and they are now slightly thickened at the ends. The basal disk is

slightly more lobed than in the preceding stage. One of the specimens (Pl. IX, Fig. 3) shows the radials II—III still small and alike, in another (Pl. IX, Fig. 4) they have already become considerably differentiated. The radial II is still narrow and slender, only somewhat widened at the lower end, where it joins the now distinctly pentagonal radial I. The axillary has widened and at its outer end the first arm joints have just appeared. (This specimen is then, strictly spoken, in the stage III already). The basalia have increased considerably at the upper side, and there is now scarcely a trace of a straight upper edge, the radialia nearly joining so as to separate the basalia from the oralia; these latter have increased considerably along the outward turned edges. The anal plate is distinct as yet. The second sacculus has appeared.

Stage III. This stage, characterised by the presence of the first arm-joints, is represented by two specimens attached to cirri, one to the 27th, the other to the 28th joint, and by a pair of loose specimens. The complete specimens are 13—15 mm long, the calyx with the arms being 1·5—2 mm (Pl. X, Fig. 2). The number of stalk joints is 33—35. The longest joints are 0·6 mm long, 0·1 mm broad. The upper 6—7 joints are short, but not broader than those below (Pl. IX, Fig. 5). The middle ones (Pl. XI, Fig. 4) are quite cylindrical, without distinct traces of the primary ring, only the ends are distinctly widened in the same way as described and figured by Sars in the Pentacrinoid of *H. Sarsii*, the widened ends being slightly compressed from the opposite side in the two ends of each joint, the long axis of the joint-surfaces thus being at a right angle in each two successive articulations (Comp. Sars. Op. cit., p. 54, Pl. V, Fig. 16). The joints are otherwise not compressed. The joint-surfaces (Pl. XII, Fig. 2) are essentially as figured by Sars for the Pentacrinoid of *H. Sarsii* (Op. cit. Pl. VI, Figs. 17—18), but the keel is not so distinctly serrate as figured by Sars (Pl. XII, Fig. 3). It is, however, very difficul tto observe these details on such small objects. — The lower joints (Pl. XI, Fig. 3) gradually become shorter, the lowermost one being only about half as long as wide. The basal disk is rather large and coarsely lobed.

In the calyx a conspicuous difference from the foregoing stage is noticed (Pl. IX, Fig. 5). The radialia have joined completely above the basalia and have a rather long vertical side-edge. The basalia end in an angle above and are thus now pentagonal; probably they have ceased growing along the upper edges. The radialia are somewhat thickened at the upper side, where the arms emerge. Radialia II and III (the axillary) are still long and narrow. The oralia still retain their characteristic shape and are contiguous with the

edge of the calyx; also the anal plate is distinct as yet (Pl. XI, Fig. 6). Hydropores I have been unable to observe in the orals in this or any of the preceding stages. The armjoints (Pl. XII, Fig. 4) are in accordance with the description given by Sars of those of *H. Sarsii* in the corresponding stage (Op. cit. p. 50); side plates are developed; they are somewhat more branched than those found in the pinnules of the adult.

The next stages, showing the development of the pinnulæ and cirri and the transformation of the calyx, are unfortunately not found in the material at hand.

Through the kindness of Mr. J. Grieg I have had for inspection a preparation of some Pentacrinoids of *H. tenella,* which species is regarded by Grieg as synonymous with *H. Sarsii* (Echinoderms v. Michael Sars, II, Crinoidea, p. 20). While I do not see any distinct differences of undoubted specific value in the calyx, the stalk-joints differ conspicuously from those of *H. prolixa,* being distinctly hourglass-shaped and much more robust, as is seen by comparing figs. 4 and 7 of Pl. XI, both being equally magnified.

A Pentacrinoid of *Hathrometra dentata* has been figured by Verrill (Results of the Explorations made by the Steamer Albatross off the Northern Coast of the U. S. in 1883. Ann. Rep. Comm. of Fish and Fisheries, Washington 1885, Pl. XXI, Fig. 58). It is in the stage III, slightly older than the specimen of *H. prolixa* figured here (Pl. X, 2 and IX, 5). The figure is not sufficiently detailed for enabling one to ascertain by which characters it is to be distinguished from the Pentacrinoids of the other *Hathrometra*-species.

The Pentacrinoid of *H. glacialis* (*A. Eschrichtii*) was described and figured by Levinsen (Kara-Havets Echinodermata. Dijmphna-Togtets zool. bot. Udbytte, 1886, p. 414 (sep. 34), Pl. XXXV, Fig. 8), viz. a specimen in the Stage V, with the first pinnulæ and cirri developed. As this figure, like that of *H. dentata,* is also too little detailed, I wished to study the original specimen somewhat more closely in comparison with the Pentacrinoids of *H. prolixa.* But unfortunately the specimen appears to have been lost. Having learned, however, that a Pentacrinoid of *H. glacialis* was preserved in the Zoological Institute of Uppsala and another in the Stockholm Museum, I applied to Professors Wirén and Théel, asking to have these specimens for examination, and with the greatest liberality, for which I beg here to tender my sincerest thanks, both the valuable specimens were sent to me. Both specimens are from Spitsbergen.

Pl. X, Fig. 1 represents the specimen from Stockholm. It is in the stage V, the first pinnulæ and cirri having appeared. The calyx (including arms) measures 5 mm, the stalk ca. 20 mm, but it must have been somewhat longer, as the lower part is wanting, probably ca. 10 joints; the part preserved consists of 35 joints. The calyx agrees with that of *H. Sarsii* in the corresponding stage (Sars, Crin. viv., Pl. V, Fig. 6), the radialia II and III have become rather broad, and the oralia have been widely separated from the radialia I. It is especially to be noticed that the oralia have the same shape as in *H. prolixa*, being concave, with the sides bent outwards. There is no trace of infrabasalia. The cirri are radial in position; they are seen to appear successively (Comp. W. B. Carpenter. Researches on the structure, Physiology and Development of Antedon rosacea. Phil. Trans., 1866, p. 733, Pl. XL). The first pinnula appears on the 12—13th arm-joint. The three upper stalk-joints are conspicuously wider than the rest; these and the two following ones are quite short; in the 6th the part below the primary ring has begun to lengthen, the length of the joints increasing gradually from here (comp. Fig. 1, Pl. X). The primary ring is very conspicuous in the upper joints, these joints being distinctly wider in the middle than at the ends. Also in the fully formed joints, where the ends are widened in the usual way, the middle of the joint is still somewhat prominent (Pl. XII, Fig. 6; the figure represents joints No. 30—31, the enlargement being the same as in the figures 4 and 7 of Pl. XI).

The specimen from Uppsala, which is attached to a cirrus of *H. glacialis,* is in stage III, the pinnulæ not having begun to appear. The calyx (including arms) measures 2 mm in length, the stalk ca. 5 mm. The oralia are still in connection with the radialia; they are of the usual concave shape. — The number and shape of the stalk-joints I have been unable to observe distinctly (the specimen was fixed to a black plate and could not be cleared in balsam). The length of the stalk is, however, so different from that of the other specimen, as also from that recorded by Levinsen (the stalk of the latter specimen was 14 mm long), that it seems scarcely credible that it would have reached a similar length in a stage corresponding to that of the other specimen. The suggestion is then that it may possibly be the larva of *Heliometra quadrata* (P. H. Carp.), which is thought by A. H. Clark to be a distinct species. Nothing can, however, be said definitely about this for the present. It should be added that the upper stalk-joints of this specimen are only slightly broader than those below.

During a stay at the Swedish Zoological Station at Kristineberg (Fiskebäckskil) in January this year (1910) I succeeded in finding a

single specimen of a Pentacrinoid of *Antedon petasus* (Düb. Kor.), the only Crinoid occurring there. I take the occasion to describe and figure here this Pentacrinoid which was hitherto unknown (Pl. X, Fig. 3).

The specimen is in a stage which corresponds to the 4th and 5th stages of Sars, both the first pinnulæ and cirri having appeared contemporaneously, while in *H. Sarsii* the pinnulæ appear before the cirri. The calyx, with the arms, measures 2 mm, the stalk ca. 4 mm. The calyx does not seem to show features of value as specific characters.[1] There is no trace of infrabasalia. The oralia are of the usual concave shape, still in connection with the radialia I. The anal plate is still distinct. The first pinnulæ are attached to the 11th—12th arm-joint. The cirri are radial in position. The stalk consists of 27 joints, the 9 upper ones being quite short, and the two uppermost ones conspicuously broader than the rest. The fully formed joints (Pl. XII, Fig. 8) are hourglass-shaped, widened at the ends in the usual way, the long axis of the joint-surfaces alternating at right angles. There is no trace of the primary ring in these joints; they are rather short, only 0·3 mm long, by 0·1 mm wide. Towards the lower end of the stalk the joints become gradually shorter, as seen in the figure. The basal disk is only slightly lobed. — The specimen was found attached to a *Balanus* on a shell of *Pecten maximus*.

When reviewing the different species of Pentacrinoids here treated one feels rather convinced that characters by which to distinguish the different species are not to be found in the calyx. The fact that pinnulae and cirri appear contemporaneously in *A. petasus* (this is also the case in the species treated by W. B. Carpenter), while in *H. Sarsii* the pinnulæ appear before the cirri, is certainly very conspicuous but it is, in any case, not of use for distinguishing the other stages (more probably this indicates a generic distinction). The more or less distinct widening of the upper stalk-joints would also appear to afford a character for specific distinction; it seems, however, not to be quite constant, and judging from the figures given by Sars, it is only on the appearance of the cirri that they begin to widen, while before this stage they are not distinctly wider than the rest of the joints. It is unfortunate that no specimens of the Pentacrinoids of *H. prolixa* have reached this stage, so it cannot be ascertained whether this holds good also for this species, but it is probable that it will prove to do so. Only the fully formed

[1] The calyx certainly appears somewhat wider than in the other specimens. This, however, depends on the fact that the specimen has been slightly compressed in the preparation, which fact also accounts for the small naked spaces seen at the upper end of the basalia.

stalk-joints appear to afford good characters for distinguishing the species — at least this holds good for the species treated here.

Asteroidea.

3. **Bathybiaster vexillifer** (Wyv. Thomson).

Pl. XIV, Figs. 2, 5. Pl. XVII, Figs. 8, 14.

Archaster vexillifer	Wyv. Thomson. 1873. The Depths of the Sea. p. 150. Fig. 25.
Bathybiaster pallidus	Danielssen & Koren. 1884. Norske Nordhavs Expedition. Asteroidea. p. 89. Pl. XIV. Figs. 1—15.
Ilyaster mirabilis	Danielssen & Koren. Ibid. p. 100. Pl. VII. Figs. 15—19.
Bathybiaster vexillifer	F. Jeffr. Bell. 1891. Observations on a rare Starfish, Bathybiaster vexillifer. Proc. Zool. Soc. p. 228. Pl. XXIII—XXIV.
— *pallidus*	H. Ludwig. 1900. Arktische Seesterne. Fauna Arctica. p. 455.
— *vexillifer*	J. Grieg. 1906. Echinodermen von . . . "Michael Sars" 1900—1903. III. Asteroidea. p. 14. Pl. I. Fig. 1.
— —	R. Koehler. 1909, Échinodermes . . . Princ. Alice. Monaco. Fasc. XXXIV. Pl. XI. Figs. 8—10.

Station 98. (77° N. 18½° W.) 304 m. 1 specimen.

In the "Michael Sars"-Asteroidea Grieg has given some excellent critical remarks on this species, showing a. o. that the "vexillum", the peculiar adambulacral appendage which has given rise to the name of the species, is not a kind of pedicellaria, as was maintained by Danielssen & Koren in their description of *Bathybiaster pallidus*, which is really the same species as *B. vexillifer*. While I quite agree with Grieg that the "vexillum" is by no means a kind of pedicellaria, I find that there is still some error in his conception of this appendage, and I therefore think it not inappropriate to give some remarks tending to show the real character of this somewhat mysterious "vexillum".

„An den innersten Adambulacralstachel, den Eckstachel, befestigt, ragt „das Vexillum“ mit dem freien Ende über die Ambulacralfurche“ . . . „Das untere Ende, was mit kurzen Ligamenten an dem Adambulacralstachel befestigt ist, ist quer abgeschitten“, says Grieg (Op. cit. p. 17). In the same way Bell writes (Op. cit. p. 229): "Attached to the spine at the angle is a blunt movable spine-like process,

the possession of which is the cause of the specific name, and which may be indifferently spoken of as a "vexillum"." Likewise Danielssen and Koren write (Op. cit. p. 90): "The mesial spine (the apex spine) is, usually, shorter than the lateral spines, and has a more rounded form. It carries upon its extremity a kind of pedicellaria . . . ."

I was at first somewhat puzzled at these descriptions. On examining the adambulacral spines of the present specimen, as well as of other specimens at hand, on places where they were unhurt, I found a simple median spine, resembling the figure of the vexillum given by Grieg (Op. cit. Pl. I, Fig. 1); but this spine I found to be attached directly to the adambulacral plate, while, according to the descriptions, it should be attached to a shorter spine, which should again be attached to the adambulacral plate.

The figure of the "vexillum" given by Bell (op. cit. Pl. XXIV, Fig. 1) is evidently such a spine, differing from the usual median spine in being broken at both the upper and lower end, while the figure given by Grieg represents a complete spine, and it is not quite reconcilable with the description, as it is evidently not inserted on a lower spine but directly on the adambulacral plate. — There is, evidently, no other explanation of the "vexillum" than that it is the broken point of the median adambulacral spine, the short inner spine to which it is said to be attached being the basal part of the broken spine. The description given by Wyville Thomson (Op. cit. p. 151): "The inner spine of each comb on the side of the adambulacral groove is longer than the others, and bears on the end a little oblong calcareous plate usually hanging from it somewhat obliquely like a flag, with sometimes a rudiment of a second attached to it in a gelatinous sheath, which makes it probable that it is an abortive pedicellaria", thus is very naturally explained. This adambulacral spine is, indeed, very fragile, and I have myself seen such as were broken both once and twice, the pieces hanging in the somewhat thick skin of the spine, but I was never in doubt that they were broken spines; probably all these spines were broken in Wyv. Thomsons specimens, otherwise he would scarcely have been misled. Grieg, on the other hand, was misled by the wrong descriptions, so that he gave an incorrect explanation of his quite correct observations. — In fact, it cannot be doubted that the "vexillum", which was regarded as so peculiar a structure, is nothing but the flattened inner adambulacral spine — or its broken point — and there is no reason for having a special name for it. In Pl. XIV, Fig. 5 I have represented the inner promi-

nent part of an adambulacral plate with the attached long median spine and the shorter lateral spines (those of the one side).

From this explanation of the "vexillum" it further follows that the shallow groove found by Bell at its upper end is only the surface of fracture. That the grooves in the "vexillum" described and figured by Danielssen and Koren are only the result of bad preparation has already been shown by Grieg. I have, upon the whole, been unable to find any groove in this spine on either side of it, and I have carefully examined from all sides several of these spines, cleaned with Eau de Javelle. They are, indeed, simply flattened. The "etwas rauhen Ränder" (Grieg) of the supposed furrow are nothing peculiar for these spines; the edge of the spine is only somewhat irregular as is generally the case in such irregular calcareous network, not developed into any special structure.

Bell (Op. cit. p. 229) describes the orifices for the passage of the tubefeet as "very deeply set, and the walls are so excavated as to form a pit which shelves inwards (Pl. XXIV, Fig. 2)". This is only the result of the drying of the animal. The openings are very large, but otherwise quite as usual in Asteroids and wholly occupied by the somewhat extraordinarily large and powerful tubefeet, which, evidently, must enable the animal to walk with considerable swiftness. The very large and muscular ampullæ (Pl. XIV. Fig. 2) also afford evidence that the tubefeet of this species must be unusually active locomotor organs. In sections it is seen that the musculature is exceedingly developed, projecting into the lumen of the ampulla (Pl. XVII. Fig. 8).

A curious feature is observed on the tubefeet, viz. that they are in their basal part set with irregular papillæ, which may even be distinctly stalked; they may be up to 2 mm long (Pl. XVII. Fig. 14). That these papillæ cannot be simply the result of the contraction of the tubefeet seems evident (the fine lamellar structure of the skin of the tubefeet, on the other hand, is certainly only caused by the contraction). It seems not unreasonable to suggest that they may have some sensory function.

4. **Pontaster tenuispinus** (Düb. & Kor.).

Astropecten tenuispinus	.	Düben och Koren. 1844. Öfversigt af Skandinaviens Echinodermer. Vet. Akad. Handl. Stockholm. p. 251. Pl. VIII. Figs. 20—22.
Archaster	—	M. Sars. 1861. Norges Echinodermer. p. 38. Pl. III. Figs. 5—7.
—	—	Danielssen & Koren. 1884. Norske Nordhavs Exp. Asteroidea. p. 85.

Pontaster tenuispinus		Sladen. 1889. Asteroidea of the "Challenger". p. 28.
—	—	Bell. 1892. On the Characters and Variations of Pontaster tenuispinus. Proc. Zool. Soc. p. 430. Pl. XXVI.
—	—	Bell. 1892. Catalogue of British Echinoderms. p. 60.
Archaster	—	Levinsen. 1896. Kara-Havets Echinodermata. p. 401. Pl. XXXIV. Figs. 10—11.
Pontaster	—	Ludwig. 1900. Arktische Seesterne. Fauna Arctica. p. 447.
—	—	Michailovskij. 1903. Echinod. Russ. Exp. Spitzbergen. p. 29.
—	—	Grieg. 1906. "Michael Sars" Asteroidea. p. 3.
—	—	Koehler. 1909. Échinodermes. Monaco. Fasc. XXXIV. p. 10. Pl. X. Figs. 1—4. Pl. XII. Fig. 6.
—	—	Süssbach u. Breckner. 1910. Die Seeigel, Seesterne u. Schlangensterne der Nord- u. Ostsee. Wiss. Meeresunters. Abt. Kiel. N. F. Bd. 12. p. 201.

Station 99 (77° N. $17^1/_2$° W.) 300 m. One small specimen. R. = 6 mm.

The larger central spine of the paxillæ has not yet made its appearance, except in a few of those in the outer end of the arms, where the central spine is slightly longer than the outer ones. Pedicellariæ are not developed on the adambulacral plates. On the other hand, I find some small pedicellariæ on the upper marginal plates in the inner part of the arms. Also in larger specimens pedicellariæ generally occur here, placed near the edge between the upper and lower marginal plates, now at the inner end of the arm, now more at the outer end. It appears that these pedicellariæ have not hitherto been observed. They occur, it should be noticed, also in specimens with the adambulacral pedicellariæ well developed. They are considerably smaller than the adambulacral pedicellariæ and consist of 3—5, generally 4, of the usual small spines placed close together so as to be able to act against one another; the spines are not specialized in any way, so it is a very primitive kind of pedicellariæ.

5. **Ctenodiscus crispatus** (Retz.).

Pl. XIV. Figs. 4, 6. Pl. XVI. Figs. 4—5.

Ctenodiscus crispatus		Lütken. 1857. Grønlands Echinodermata. p. 45.
—	—	Sars. 1861. Norges Echinodermer. p. 26.

Ctenodiscus	*corniculatus*	Duncan & Sladen. 1881. Memoir on the Echinodermata of the Arctic Sea. p. 49. Pl. III. Figs. 17—20.
—	*krausei*	Ludwig. 1886. Echinodermen des Beringsmeeres. Zool. Jahrb. Abt. f. Syst. I. p. 290. Pl. VI. Figs. 13—16.
—	*crispatus*	Levinsen. 1886. Kara-Havets Echinodermata. p. 401.
—	—	Döderlein. 1900. Zoologische Ergebnisse einer Untersuchungsfahrt des deutschen Seefischei-Vereins nach der Bäreninsel und Westspitzbergen, ausgef. im Sommer 1898. auf S. M. S. "Olga". Die Echinodermen. Wiss. Meeresunters. N. F. IV. p. 221. Taf. IX. Fig. 2—3.
—	—	Ludwig. 1900. Arktische Seesterne. Fauna Arctica. p. 450.
—	*corniculatus*	Michailovskij. 1903. Echinod. Russ. Exp. Spitzbergen. p. 28.
—	*crispatus*	Ludwig. 1905. "Albatross" Asteroidea. Mem. Mus. Comp. Zool. XXXII. p. 104. Pl. VI. Figs. 32—33.
—	—	M. Kalischewskij. 1907. Zur Kenntnis der Echinodermenfauna des Sibirischen Eismeeres. Resultats scientifiques de l'Expedit. Polaire Russe en 1900—1903, sous la direction du Baron E. Toll. Zoologie. I. (Mém. Acad. Imp. d. sci. de St. Petersb. 8. Sér. XVIII. Nr. 4. p. 24. Taf. I. Fig. 7—8. II. Fig. 2—4.
—	*corniculatus*	Koehler. 1909. Échinodermes. Monaco. Fasc. XXXIV. p. 28.

Stat. 98 (77° N. $17\frac{1}{2}$° W.) 300 m. 1 specimen. R. = 39 mm, r. = 18 mm.

It is noteworthy that the paxillæ in this species are connected at their bases by radiating muscles, very beautifully arranged (Pl. XVI. Fig. 5.). The spinelets of the paxillæ are invested in a thick skin, and generally they are united in bundles of two or three, as is especially seen very beautifully on staining the skin. The wall of the stomach is full of small, irregular spicules (Pl. XVI. Fig. 4).

In one of the interradia I found on this specimen a cluster of eggs, attached to one of the genital openings. The eggs are rather large, 0·6—0·7 mm in diameter. The ovaries are seen to contain eggs in all stages of development, from quite young to such as are quite mature, ready to be laid. These facts make it very

probable that this species has not pelagic larvæ; evidently the eggs must be laid at different epochs, since they do not become ripe at the same time, as is generally the case in those forms, where the eggs develop into pelagic larvæ.

The present specimen differs not inconsiderably from the typical form in the marginal plates being somewhat spinous and not so regular in shape (Pl. XIV, Fig. 4, to compare with Pl. XIV, Fig. 6, representing the corresponding plates from a specimen of the typical form). The limit between the upper and lower marginal plates is indistinct, on account of a thick covering skin. Whether this specimen represents a distinct variety or perhaps an individual abnormality can, of course, not be settled on the evidence of the present material. But I am inclined to regard it as an abnormal specimen. In a specimen from the Kara Sea I have found traces of a similar irregularity in the marginal plates, but much less developed than in the present specimen. — Otherwise it agrees with Kalischewskijs cold-water variety.

Concerning the most interesting geographical distribution of this species, see below, p. 294.

6. **Poraniomorpha tumida** (Stuxberg).

Pl. XVI, Figs. 6—7.

Solaster tumida Stuxberg. 1878. Echinodermer från Novaja Semljas haf, samlade under Nordenskjöldska Expeditionerna 1875—1876. Öfvers. Vet. Selsk. Förhandl. 1878. p. 31. Pl. VI.

Asterina — Danielssen & Koren. 1884. Norske Nordhavs Exp. Asteroidea. p. 60. Pl. X. Figs. 1—4. Pl. XI. Figs. 7—8. Pl. XV. Fig. 2.

— — var. *tuberculata*. Danielssen & Koren. Ibidem. p. 63. Pl. X. Figs. 5—7. Pl. XV. Fig. 3.

— — Levinsen. 1886. Kara-Havets Echinod. p. 399. Pl. XXXIV. Fig. 9.

Rhegaster tumidus Döderlein. 1900. "Olga"-Echinodermen. p. 219. Taf. IX. Fig. 1, 1 a.

— — Ludwig. 1900. Arktische Seesterne. Fauna Arctica. p. 459.

— — Th. Mortensen. 1903. Echinoderms from East Greenland. p. 74.

— — Michailovskij. 1903. Echinod. Russ. Exped. Spitzbergen. p. 26, 70.

Poraniomorpha (Rhegaster) tumida Grieg. 1906. "Michael Sars" Asteroidea. p. 34. Taf. I. Fig. 3.

Poraniomorpha (*Rhegaster*) *tumida*	Grieg. 1909. Duc d'Orléans, Croisière Océanographique de la Belgica dans la mer du Grönland. 1905. Invertébrés du Fond. p. 554.

I quite agree with Östergren (Zoolog. Anzeiger. XXVII. 1904. p. 615) and Grieg (Op. cit.) that the genera *Rhegaster* and *Lasiaster* should be united with *Poraniomorpha,* or at least that the species *Rh. Murrayi* and *Lasiaster hispidus* must be referred to that genus. As to whether the two genera mentioned may perhaps be maintained for some of the other species referred to them, I am not prepared to say anything at present. (Recently S. Süssbach & A. Breckner, "Die Seeigel, Seesterne and Schlangensterne der Nord- und Ostsee". p. 217. Taf. I. Figs. 4—6, describe a new species, *Culcita borealis*, founded on a specimen from North of the Shetland Islands, which appears to me to be only an unusually swollen specimen of *Poraniomorpha hispida* (Sars). I have seen specimens of both the latter species and of *Porania pulvillus* (O. F. Müll.) swollen in a similar way, or even still more).

Grieg has called attention to the fact that the "paxillæ" of this species described by Danielssen and Koren, and also by Levinsen, are not true paxillæ; they must be termed spinelets. On the other hand, the figure of such a spinelet given by Grieg does not seem to me very satisfactory (as is also the case with those given by Danielssen & Koren), so I have taken the occasion to give a pair of figures thereof (Pl. XVI. Figs. 6—7). As it appears here the basal part of the spinelets is somewhat widened and consists of an open, irregular network, very different from the upper part of the spinelet. These short spinelets standing erect, close together, quite resemble a fine granulation, as it is characterized by Döderlein. Those of the oral side (Pl. XVI. Fig. 7) are slightly longer and more slender, but otherwise constricted as those of the dorsal side. They are not erect as those of the dorsal side, therefore not producing the aspect of granulation.

Station 104 (76° 6′ N. 13° 26′ W.). 200—250 m. 1 specimen.

7. **Cribrella sanguinolenta** (O. Fr. Müller).

Echinaster oculatus	Düben & Koren. 1844. Öfvers. af Skandinav. Echinodermer. p. 241.
Cribrella sanguinolenta	Lütken. 1857. Grønlands Echinodermata. p. 31.
Echinaster sanguinolentus	Sars. 1861. Norges Echinodermer. p. 84.
Cribrella oculata	Duncan & Sladen. 1881. Memoir. Ech. Arctic Sea. p. 32. Pl. II. Figs. 18—21.

Cribrella oculata	Danielssen & Koren. 1884. Norske Nordhavsexped. Asteroidea. p. 34.
Echinaster scrobiculatus	Danielssen & Koren. Ibidem. p. 40. Pl. VI. Figs. 10—11. Pl. VII. Figs. 12—14.
Cribrella sanguinolenta	Ludwig. 1900. Arktische Seesterne. Fauna Arctica. p. 472.
— *oculata*	W. M. Rankin. 1901. Echinoderms collected off the West Coast of Greenland by the Princeton Arctic Expedition of 1899. Proc. Acad. Nat. Sc. Philadelphia. p. 174.
— *sanguinolenta*	Grieg. 1902. Oversigt over det nordlige Norges Echinodermer. Bergens Mus. Årbog. 1902. p. 28.
— —	Th. Mortensen. 1903. Echinoderms from East Greenland. p. 72. Pl. II. Figs. 7—8.
— —	Michailovskij. 1903. Echinod. Russ. Exped. Spitzbergen. p. 19—21.
— —	H. Lym. Clark. 1904. The Echinoderms of the Woods Hole Region. Bull. U. S. Fish. Comm. for 1902. p. 555. Pl. III. Figs. 10—11. Pl. IV. Fig. 22.
— *oculata*	Koehler. Échinodermes. Monaco. XXXIV. p. 102.
— *sanguinolenta*	Süssbach u. Breckner. 1910. Seeigel, Seesterne u. Schlangensterne d. Nord- u. Ostsee. p. 224.

Forma *scabrior* Michailovskij.

Stat. 63. Stormbugt, 10—20 m. 1 large specimen (R = 42 mm).
— 72. a. — — 1 specimen.

Forma *lævior* Michailovskij.

Stat. 57. a. Danmarks Havn, 15—20 m. 3 specimens.
— 63. Stormbugt, 10—20 m. 1 specimen.
— 104. (76° 6′ N. 13° 26′ W.), 200—250 m. 1 specimen.

In the "Echinoderms from East Greenland" (loc. cit.) I pointed out that two rather distinct forms of this species may be distinguished, one having single dorsal spines, not trifid at the point, and the adambulacral plates carrying only a single transverse series of spines; the other having the spines in groups (pseudopaxillæ) and trifid at the point, and the adambulacral plates carrying double transverse series of spines. The question of the possible specific value of these two forms was postponed till a future occasion. — Contemporane-

ously Michailovskij found the two same types and distinguished them as forma *lævior,* the typical form, and forma *scabrior,* that with the single spines. Until a careful revision of the species has been undertaken, I think it right to distinguish these two forms. — Probably the forma *scabrior* will prove to be a special cold-water form, as *Solaster glacialis* and *S. papposus*, var. *squamatus*; but the fact that the forma *lævior* occurs together with f. *scabrior* in the cold region makes the case more intricate.

The specimen from Stat. 72 has a very extraordinary appearance and at the first aspect does not appear to belong to this species. The difference is, however, only occasioned by the skin covering the spines being very thick and swollen; otherwise the specimen agrees completely with the forma *scabrior*. The spines are not united by weblike expansions of the skin.

8. **Pteraster militaris** (O. Fr. Müller).

Pl. XVI. Fig. 2. Pl. XVII. Figs. 1, 11.

Pteraster militaris Düben & Koren. 1844. Öfvers. Skand. Ech. p. 246. Tab. VII. Figs. 11—13.
— — Lütken. 1857. Grønlands Echinod. p. 43.
— — Sars. 1861. Norges Echinod. p. 48. Tab. III. Figs. 8—9. Tab. IV—VI.
— — Duncan & Sladen. 1881. Mem. Echinod. Arctic Sea. p. 46. Pl. III. Figs. 13—16.
— — Danielssen & Koren. 1884. Norske Nordh. Exp. Asteroidea. p. 70. Pl. XIII. Figs. 18—19.
— — Ludwig. 1900. Arktische Seesterne. Fauna Arctica. p. 469.
— — Grieg. 1902. Overs. nordlige Norges Echinodermer. p. 27.
— — Th. Mortensen. 1903. Echinoderms from East Greenland. p. 77. Pl. II. Figs. 4—5.
— — Süssbach u. Breckner. 1910. Seeigel, Seesterne u. Schlangensterne d. Nord- u. Ostsee. p. 226.

Station 63. Stormbugt, 10—20 m. 1 specimen, poorly preserved.

I have been unable to find in the dorsal skin of this specimen any of the calcareous corpuscles otherwise so characteristic of this species. — The figures given by Sars of these corpuscles do not appear to me very satisfactory, so I have taken the occasion to give a few, more detailed figures of them from some other Greenlandic specimens (Pl. XVII. Figs. 1, 11).

The paxillæ of this specimen bear 4 spinelets.

Ludwig[1] has suggested that the *Pteraster aporus* described by him in his paper: Echinodermen d. Beringsmeeres. p. 293 may prove to be identical with *Pt. militaris*. I think he is right in this suggestion; the lacking of the oscular pore is probably only the result of the preservation, and in the other characters given in the description there do not seem to be any differences of importance from *militaris*.

9. **Pteraster pulvillus** M. Sars.

Pl. XIV. Fig. 3. Pl. XVI. Fig. 3.

Pteraster pulvillus Sars. 1861. Norges Echinodermer. p. 62. Tab. VI. (Pro parte).
— — Döderlein. 1900. "Olga"-Echinodermen. p. 217. Taf. VIII. Fig. 10—10 a.
— — Ludwig. 1900. Arktische Seesterne. Fauna Arctica. p. 470.
— — Grieg. 1902. Nordlige Norges Echinodermer. p. 27.
— — Michailovskij. 1903. Echinod. Russ. Exped. Spitzbergen. p. 68.
— — Süssbach u. Breckner. 1910. Seeigel, Seesterne u. Schlangensterne d. Nord- u. Ostsee. p. 227.

Stat. 71. Cap Bismarck, 15—20 m. 1 specimen.

Besides the difference in the number of spinelets of the paxillæ between this species and *militaris* pointed out by Sars in his description of these two species it may be worth mentioning that also the shape of these spinelets differs very considerably. While in *militaris* they are simple fenestrated rods, scarcely widened at the point, they are in *pulvillus* much widened in the point, almost bush-shaped (Pl. XVI. Figs. 2 and 3). These spinelets are very fragile, so that it may be difficult enough to obtain one with the point undamaged; this holds good of both species.

The "sphæridiæ" (Pl. XIV. Fig. 3) are essentially like those of *Pt. militaris* as described in my paper on the "Echinoderms from East Greenland", only more slender and more smooth.

10. **Solaster glacialis** Dan. Kor.

Solaster glacialis Danielssen & Koren. 1884. Norske Nordh. Exp. Asteroidea. p. 42. Pl. VIII. Figs. 9—10. Pl. IX. Figs. 1—6. Pl. XV. Fig. 1.
— *endeca* Levinsen. 1886. Kara-Havets Echinodermata. p. 398.

[1] Arktische Seesterne. p. 470.

Solaster syrtensis	Döderlein. 1900. "Olga"-Echinodermen. p. 210. Taf. VII. Figs. 2—3.
—	—	Grieg. Nordl. Norges Echinodermer. p. 24.
—	—	Th. Mortensen. 1903. Echinoderms from East-Greenland. p. 74.
—	—	Michailovskij. 1903. Echinod. Russ. Exped. Spitzbergen. p. 69.
—	*glacialis*	Grieg. 1906. "Michael Sars" Asteroidea. p. 67.
—	*endeca*	var. *glacialis*. Koehler. 1909. Échinodermes. Monaco. Fasc. XXXIV. p. 114. Pl. V. Figs. 2—3.

Stat. 94. The Sound at Cap Bismarck, ca. 30 m. 1 specimen, with ten arms.

While Döderlein has the merit of having shown definitely the distinctness of this species, Grieg has the merit of having cleared up its synonymy, showing it to be the same as the *Solaster glacialis* of Danielssen and Koren. On the other hand I cannot feel convinced that Grieg is right in regarding the *Solaster echinatus* Storm as a synonym of *S. glacialis*.

Danielssen & Koren (Op. cit.) describe *S. glacialis* as having the interbrachial spaces of the oral side beset with a few spines placed irregularly (Pl. IX. Fig. 2. a.). As the specimen is a small one (R = ca. 25—30 mm, according to Grieg), this will not be any serious objection to the identification with the "*Solaster syrtensis*" of Döderlein, in which the oral interbrachial spaces bear true paxillæ. In a young specimen of this species from the Kara Sea (R = 16 mm) the oral interbrachial spaces carry only a few small groups of spines, 3—4 together, resembling very much the condition in the type specimen of *glacialis*.

The type specimen of *S. echinatus* is described as having spines, not paxillæ, in the interbrachial spaces, 2—3 together, as shown in the Fig. 6 of Storm's paper (Solaster echinatus n. sp., tilligemed Oversigt over de i Trondhjemsfjorden fundne Asterider. Kgl. Norsk Vidensk. Selsk. 1886—87). But this specimen is not a young one, its arm radius being, according to Grieg, 90 mm. In the specimens of *S. glacialis* at my disposal I have not seen a similar condition. Accordingly it seems to me not definitely proved that *S. echinatus* is really a synonym of *S. glacialis*, so long as this difference has not been removed.

Whether *Solaster syrtensis* Verrill is really identical with *S. glacialis*, must remain doubtful, until a more detailed description of *syrtensis* has been given or a direct careful comparison of the two forms has been undertaken. Döderlein, otherwise, has already hinted at

the possibility of the American species being distinct from the Arctic form. — As pointed out by Grieg (Op. cit. p. 69), *S. glacialis* seems to be a more arctic species than *endeca.* It is well worth noticing in this connection that the specimens from West Greenland, preserved in the Copenhagen Museum, prove to belong exclusively to the true *S. endeca.* Likewise all the specimens in hand from Iceland belong to this species, while, on the other hand, the true *S. endeca* is not known to occur at East Greenland. These facts, together with those mentioned by Grieg, decidedly point towards the conclusion that *S. glacialis* is a true arctic species, not descending into the boreal region, while *S. endeca* is a boreal form, proceeding far northwards along the Norwegian Coast to Spitzbergen, and in the Davis Strait along West Greenland. — This distribution of the two species is decidedly not in favour of the supposition that *S. glacialis* and *syrtensis* are really identical.

Grieg suggests that the large specimen from the Kara Sea mentioned by Levinsen under *Solaster endeca* may prove to be *glacialis.* Having reexamined the specimen, I can state that Grieg's suggestion is correct, and I may add that also the small specimens mentioned there belong likewise to *S. glacialis.*

11. Solaster papposus (L.).

Solaster papposus Lütken. 1857. Grønlands Echinod. p. 40.
— — Sars. 1861. Norges Echinodermer. p. 76.
Crossaster — Duncan & Sladen. 1881. Mem. Echinod. Arct. Sea. p. 36. Pl. III. Figs. 1—4.
Solaster — Danielssen & Koren. 1884. Norske Nordh. Exp. Asteroidea. p. 48. Pl. IX. Fig. 12.
— — Fischer. 1886. Echinodermen. Oesterreichischen Polarstation Jan Mayen. III. p. 33.
— — Döderlein. 1900. "Olga"-Echinodermen. p. 205. Taf. VI. Figs. 1—5.
Crossaster — Ludwig. 1900. Arktische Seesterne. Fauna Arctica. p. 460.
— — Rankin. 1901. Echinoderms . . . . West Greenland. p. 174.
Solaster — Th. Mortensen. 1903. Echinoderms from East Greenland. p. 75. Pl. II. Fig. 6.
Crossaster — Michailovskij. 1903. Echinod. Russ. Exped. Spitzbergen. p. 25, 69.
Solaster — Grieg. "Michael Sars" Asteroidea. p. 46. Tab. I. Figs. 6–8.

Solaster papposus Grieg. 1907. Report on the Second Norwegian Arctic Expedition in the "Fram" 1898—1902. No. 13. Echinodermata. p. 6. Pl. I. Figs. 1—2. Pl. II.

Crossaster — Kalischewskij. 1907. Echinodermenfauna d. Sibirischen Eismeeres. p. 30.

— — Koehler. 1909. Échinodermes. Monaco. Fasc. XXXIV. p. 111. Pl. II. Fig. 6. Pl. IV. Figs. 4, 5.

Solaster — Süssbach u. Breckner. 1910. Seeigel, Seesterne u. Schlangensterne d. Nord- u. Ostsee. p. 223.

Station	36.	Danmarks Havn, 10—20 m.	1	specimen,	12	armed.
—	63.	Stormbugt —	1	—	10	—
—	64.	Cap Helgoland, 100 m.	1	—	10	—
—	66.	Stormbugt, 30 m.	1	—	12	—
—	72.	— —	1	—	12	—

While it must be acknowledged that the form first distinguished by Döderlein as Var. *squamatus* is distinct enough and perhaps entitled to specific rank, as is recently given to it by Grieg, I cannot feel equally convinced of the value of the variety distinguished by Grieg as the cold-water form, var. *affinis* (Brandt). One of the more prominent differences is to be found in the number of the paxillæ of the oral interbrachial spaces, they being numerous in the cold-water form, few or quite wanting in the southern form, though — it is agreed — they are sometimes numerous also in the latter form. — The two larger of the specimens from the Danmark Expedition, which ought to belong to the cold-water variety according to the locality, have, however, the interbrachial spaces nearly or quite naked. As none of the other distinguishing features pointed out by Grieg seem to be more constant, it appears that these varieties can scarcely be so distinct, as Grieg is inclined to think.

I may take the occasion here to state that all the specimens of *Solaster papposus* from West Greenland, preserved in the Museum of Copenhagen, belong to the typical form. — The relation between *S. papposus* and *squamatus* is evidently the same as between *S. endeca* and *glacialis*, the former being a boreal form of wide geographical distribution, the latter a cold-water form, restricted to the cold region.

Pedicellaster palæocrystallus Sladen.

Pl. XIV. Figs. 1, 9. Pl. XV. Figs. 1, 4, 7.

Pedicellaster palæocrystallus Duncan & Sladen. Mem. Echinodermata of the Arctic Sea. p. 34. Pl. II. Figs. 22—26.

Stat. 63. Stormbugt, 10—20 m. 1 specimen (R. = 7 mm, r = 2 mm).
— 96. ($76^{3}/_{4}$° N. 18° W.), 160—178 m. 2 specimens (R. = 10, 11 mm, r = 2·8, 3 mm).

According to Danielssen and Koren (Norske Nordhavs-Exped. Asteroidea p. 36) *Pedicellaster palæocrystallus* Sladen is a synonym only of *P. typicus* Sars. The examination of the specimens from the Danmark Expedition, which certainly belong to the form described by Duncan & Sladen, has, however, convinced me that such is not the case. I find this form differing not inconsiderably from *P. typicus* in several points, so that it must certainly be maintained as a distinct species. Evidently *P. palæocrystallus* represents the cold-water form, while *P. typicus* is a warm-water form (boreal), in analogy with so many other Echinoderms of the Northern Atlantic.

The characters given by Duncan and Sladen for this species are the following: "*P. palæocrystallus* is of larger size, and the length of the arm-radius, in proportion of the disk (about 5:1) is less than in *P. typicus*, in the largest examples of which it is $6^{1}/_{2}$ or 6 : 1. The contour of the arms is also different in our form, being more tumid on the inner third, and much more attenuated on the remaining outward portion of the ray. The dorsal spinelets are decidedly radio-laminate and somewhat expanded at the tip, instead of being conical, as described in *P. typicus*, and the shaft of the ambulacral spinelet is also denticulate or serrate. The pedicellariæ of the present species are even of relatively larger size, and differ in having the contour of the jaws considerably swollen out about the outer third, and then tapering rapidly towards the extremity, which is somewhat truncate".

Regarding the length of the arms it seems evident from the measurements given by Danielssen & Koren that it cannot be relied upon as a specific character. In the specimens from the cold region the relative arm-length is seen to be from 1 : $3^{3}/_{4}$ to 1 : 7, in those from the warm area from 1 : $2^{1}/_{2}$ to 1 : 5. (In the specimens from the Danmark Expedition the proportion is from 1 : $3^{1}/_{2}$ to 1 : $3^{2}/_{3}$). The form of the arms, on the other hand, seems to be a good distinguishing character. The specimens in hand agree with Duncan & Sladen's description in this respect (the two specimens from Stat. 96 are so badly preserved, that the shape of the arms is difficult to see; in the specimen from Stat. 63 this feature is very distinct), and Danielssen & Koren likewise remark that "in a few specimens, and specially in those from the cold area, the rays were rather broad, and tumid at the origin, whilst, in others, again, they

were narrower". Judging from the material at my disposal there are, however, some other, apparently more important differences in the arms of the two species. The ambulacral furrow is in *palæocrystallus* of uniform width from the mouth to the outer part of the arm or, at most, there is a slight narrowing at the inner end (Pl. XIV. Fig. 9), while in *P. typicus* it is distinctly narrowed in the inner part, reaching its greatest width somewhat outside the disk (Pl. XIV. Fig. 7).[1] Further the number of tubefeet seems to be somewhat smaller in *palæocrystallus* than in *P. typicus*, as seen by the following numbers and measurements.

P. palæocrystallus		*P. typicus*	
Length of R.	Number of pairs of tubefeet	Length of R.	Number of pairs of tubefeet
7 mm	20—22	6 mm	ca. 30
10 —	30	11·5 —	35
11 —	31	12	36

This difference is certainly not very conspicuous, but judging from the material at my disposal there seems to be a distinct difference herein between the two species.

The spines in general give the impression of being somewhat coarser in *palæocrystallus* than in *typicus*, which is, however, only due to the preservation of the skin in a more or less contracted condition. In the structure of the spines I do not find any reliable difference, either in the adambulacral or the dorsal spines. The adambulacral spines (Pl. XIV. Fig. 1) I do not find so slender as figured by Duncan and Sladen (Op. cit. Pl. II. Fig. 24). They may be more or less thorny in both species.

The pedicellariæ afford a rather distinct difference in the two species, as correctly pointed out by Duncan and Sladen. When Danielssen and Koren (Op. cit. p. 37) state that "most of the pedicellariæ, especially those found in the lateral surfaces of the rays of Sars' original specimen, as well as, upon the rays of the other specimens at our disposal, and which we have had under examination, are formed, exactly, like those described and illustrated by Dr. Sladen", this must certainly be due to their not having examined them very thoroughly, or to the confounding of the two types. At least the material at my disposal shows a not inconsiderable difference in the structure of the pedicellariæ of the two species (Pl. XV. Figs. 1,

[1] In some specimens of *P. typicus* from the Kola-Fjord sent to me for examination by Dr. K. Derjugin, St. Petersbourg, after this had been sent to press, I find the constriction of the ambulacral furrow towards the mouth less distinct. This makes meless sure of the specific difference of the two forms. A much larger material than that at my disposal will be necessary for settling this question definitely.

4, 7 (*palæocrystallus*), to compare with Pl. XV. Figs. 2, 3, 5, 6 (*P. typicus*)). — In *P. typicus* there are two distinct types of cruciform pedicellariæ; those on the lower side of the arms are elongate, with large teeth, especially a series of ca. 5 teeth along the inner median part being prominent, the upper edge being narrow (Pl. XV. Figs. 5, 6); those on the dorsal side are considerably smaller, with no prominent median teeth, and with the upper edge broader (Pl. XV. Figs. 2—3). In *P. palæocrystallus* the two forms are less different in size; the larger form (Pl. XV. Figs. 4, 7) is less elongate and has only 2—3 more prominent median teeth. The smaller form (Pl. XV. Fig. 1) is, generally, somewhat more coarsely dentate along the upper edge; this difference is, however, not quite constant.

I may also add that in both species the three inner adambulacral spines are single, the inner one being placed at a lower level than the others, more or less hidden within the mouth space (Pl. XIV. Figs. 7, 9); from the 4th they are double.

Evidently the arms of these species, especially *typicus*, are very fragile; it is seldom to find all the arms of a specimen equal in length, and often it is distinct that the outer part of an arm is regenerated.

One point still I may call attention to, viz. that the eye spot in *P. typicus* is exceptionally large; it would evidently be a very favourable object for a detailed study of this structure. In *P. palæocrystallus* it is not so large.

13. **Stichaster albulus** (Stimpson).

Pl. XIII. Figs. 1—6. Pl. XIV. Fig. 8. Pl. XV. Figs. 8—10. Pl. XVII. Fig. 12.

Asteracanthion problema	Steenstr. Lütken. 1857. Grønlands Echinod. p. 30.
Stichaster albulus	Duncan & Sladen. 1881. Mem. Echinodermata Arctic Sea. p. 29. Pl. II. Figs. 13—17.
— —	Danielssen & Koren. 1884. Norske Nordh.-Exped. Asteroidea p. 3. Pl. VIII. Figs. 13—15.
— —	Fischer. 1886. Echinodermen. Oesterreich. Polarstat. Jan Mayen. p. 32.
— —	Ludwig. 1900. Arktische Seesterne. Fauna Arctica. p. 479.
— —	Th. Mortensen. 1903. Echinoderms from East Greenland. p. 72.
— —	Michailovskij. 1903. Echinod. Russ. Exped. Spitzbergen. p. 18, 66.
— —	Grieg. 1907. Echinodermata. II. "Fram" Exped. p. 10.

Nanaster (*Stichaster*) *albulus* Koehler. 1909. Échinodermes. Monaco. XXXIV. p. 107.

Several specimens from Stations: 16, 21, 25, 27, 36, 48, 49, 50, 53, 56, 57, 58, 60, 61, 63, 69, 71, 72.[1]

There are several large specimens among them, the largest having R = 33 mm. These are almost all 7-armed, only one of these large specimens is 6-armed. The arms are all fully developed and nearly of the same length (Pl. XIII. Figs. 2, 5); it seems evident that these specimens are fullgrown and have ceased the self-division. — Some of the younger specimens show a curious crowding of the regenerating arms, some of them being pushed down on the oral side, turning their ambulacral furrow against the ambulacral furrow of the larger arms and their dorsal side downwards, the result being a most curious irregularity (Pl. XIII. Figs. 4, 6). In a specimen from Stat. 58 two of the larger arms are coalesced nearly in their inner half length, the ambulacral furrows remaining separate (Pl. XIII. Fig. 1); another specimen from the same station shows a similar concrescence, but to a smaller extent. In a specimen from Stat. 60 the curious feature is seen that, besides the usual reproduced half part, a pair of young arms are growing out between two of the large arms (Pl. XIII. Fig. 3).

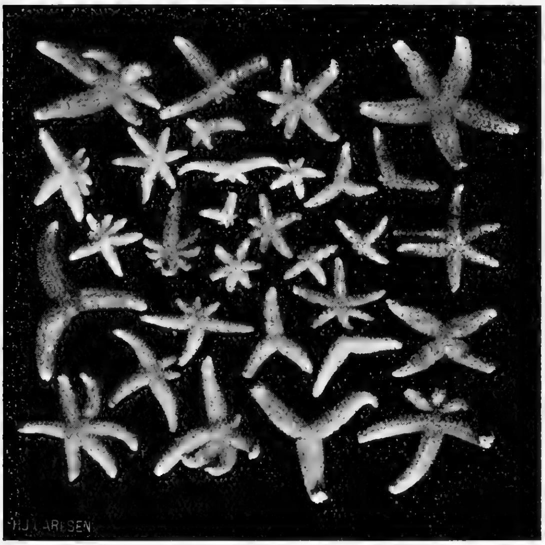


Fig. 3. *Stichaster albulus.* Nat. size.

The text-figure 3 represents some different division-stages of this curious species. The figure was made for a popular account on the Fauna of Greenland, but I have thought it well worth reproducing here.

The dorsal spines (Pl. XIV. Fig. 8) end in 3—4 erect thorns, as correctly described by Duncan & Sladen. The adambulacral spines are somewhat longer and coarser, but likewise thorny only at

[1] The localities of the different stations are given below, p. 300.

the point; there are generally some more thorns than in the dorsal spines. In the Pl. II. Fig. 16 of Duncan & Sladen the adambulacral spines are represented somewhat too slender. (This figure also shows only two series of tubefeet, a rather conspicuous inaccuracy).

In the larger specimens I find the straight pedicellariæ generally arranged in a continuous, close series inside the adambulacral spines, not "at intervals of every two or three adambulacral plates", as stated by Duncan & Sladen (p. 30). The description and figure of these pedicellariæ given by Danielssen & Koren (Op. cit. p. 34. Pl. VIII. Fig. 14) I find not very correct; especially it may be noticed that the "rostelformed extremity" in which they are said to end, is by no means a constant feature; I have, upon the whole, not observed such as resembled the said figure very closely. Generally I find them as figured in Pl. XVII. Fig. 12. But these pedicellariæ are, as is generally the case in Asteroids, very little specialized and inconstant as regards teeth and other prominences, in marked contrast to the cruciform pedicellariæ (— not to speak of the pedicellariæ of Echinoids).

The cruciform pedicellariæ (Pl. XV. Figs. 8—10) differ so markedly from the description and figure given by Danielssen & Koren (Op. cit. p. 33. Pl. VIII. Fig. 13), that one cannot help thinking that it is not at all the cruciform pedicellariæ of this species they are describing. I am not going to try to find out what it really is, but hope to have shown sufficiently by the figures given here that it cannot be the cruciform pedicellariæ of *Stichaster albulus*. A detailed description of these structures seems to me superfluous; it is, in fact, a quite common form, resembling those of several species of *Asterias*.

Some specimens from Stat. 70 have a somewhat peculiar appearance on account of the skin covering the pedicellariæ on the dorsal side being dark coloured on the top, the line along which the pedicellaria opens remaining uncoloured, so that each pedicellaria appears as a small brownish knob with a white line across. At first sight one is tempted to think this is another species, but a close examination shows the structure of the pedicellariæ to be exactly as in the other specimens, and as no other differences appear to exist, these specimens must evidently be referred to *St. albulus*.

The colour of this species is stated by Mr. Fr. Johansen to be faint yellowish, transparent, as is also shown by a coloured sketch, which he has made from a living young specimen. This statement is contradictory to that of Lütken (Grønlands Echinodermata, p. 30), according to which the colour of this species is pink.

14. **Asterias panopla** Stuxb.

Pl. XVII. Fig. 2.

Asterias panopla Stuxberg. 1878. Echinodermer från Novaja Semljas Haf, samlade under Nordenskiöldska Expeditionerna 1875—76. Öfvers. Vet. Akad. Förhandl. 1878. p. 32.

— — Danielssen & Koren. 1884. Norske Nordh. Exp. Asteroidea. p. 17. Pl. V.

— — Levinsen. 1886. Kara-Havets Echinod. p. 394.

— — Döderlein. 1900. "Olga"-Echinodermen. p. 204. Taf. IV. Fig. 1. Taf. V. Fig. 1—2.

— — Ludwig. 1900. Arktische Seesterne. Fauna Arctica p. 486.

— — Th. Mortensen. 1903. Echinoderms from East Greenland. p. 70. Pl. II. Fig. 1.

— — Michailovskij. 1903. Echinod. Russ. Exped. Spitzbergen. p. 15, 65.

— — Kalischewskij. 1907. Echinodermenfauna d. Sibirischen Eismeeres. p. 46. Tab. II. Fig. 12—15. Tab. III. Fig. 1—4.

— — Grieg. 1907. Echinodermata. II. "Fram"-Exp. p. 13.

— — Koehler. 1909. Échinodermes. Monaco. XXXIV. p. 120.

Stat. 98 (77° N. 17$^1/_2$° W.). 300 m. 1 specimen.

The present specimen is of the typical form, closely resembling the excellent figure given by Döderlein (Taf. IV. Fig. 1).

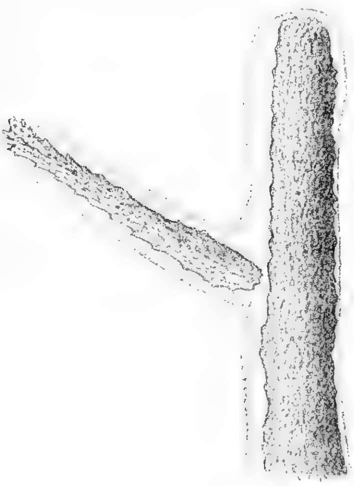


Fig. 4. Branching spine of *Asterias panopla*. $^{27}/_1$.

While, as pointed out by Döderlein (Op. cit. p. 205), the spines of this species do not carry pedicellariæ-bundles, as is otherwise generally the case in this genus, the spines sometimes present a sort of appendages, which, on a superficial examination, might be taken to be straight pedicellariæ. It is, however, only a sort of branching of the spine; but the skeleton of the branch lies loose in the skin, without any direct connection with the skeleton of the spine itself and there is no trace of such a connection ever having existed (Fig. 4). It is thus a sort of "false ramification".

In the thick skin covering the adambulacral a. o. spines a great number of cells occur containing a fine granular substance (Pl. XVII. Fig. 2). They may probably be mucus secreting cells.

Ophiuroidea.

15. **Ophiopleura borealis** Danielssen & Koren.

Pl. XIII. Figs. 7—8.

Ophiopleura borealis Danielssen & Koren. 1877. Fra den Norske Nordhavs-Expedition. Nyt Magas. for Naturv. XXIII. p. 33. Pl. V. Figs. 1—4.
— *arctica* 1881. Duncan & Sladen. Mem. Echinod. Arctic Sea p. 55. Pl. IV. Figs. 1—21.
— *borealis* Levinsen. 1886. Kara-Havets Echinod. p. 403. Pl. XXXV. Figs. 1—2.
— — Fischer. 1886. Echinodermen. Oesterreich. Polarstat. Jan Mayen. p. 35.
— — Grieg. 1893. Ophiuroidea. Norske Nordhavs-exped. p. 3. Pl. I. Figs. 1—5.
— — Grieg. 1900. Die Ophiuriden der Arktis. Fauna Arctica. p. 261.
— — Grieg. 1903. Echinodermen von dem norwegischen Fischereidampfer "Michael Sars" in den Jahren 1900—1903 gesammelt. I. Ophiuroidea. Bergens Mus. Årbog. 1903. p. 15.
— — Th. Mortensen. 1903. Echinoderms from East Greenland. p. 84.
— — Koehler. 1909. Échinodermes. Monaco. XXXIV. p. 142. Pl. VI. Fig. 4.

Stat. 99 (77° N. 17½° W.) 300 m. Several specimens, of different sizes, from 3 to 35 mm diameter of disk. The genital slits have appeared already in the smallest specimens.

One specimen shows a very curious abnormality. It looks as if part of the disk with the corresponding arm has been cut off and the arm alone reproduced. Whether this has really been the case cannot be ascertained; but in any case it has seemed to me worth figuring the curious specimen (Pl. XIII. Figs. 7—8).

16. **Ophioglypha robusta** (Ayr.).

Pl. XVI. Fig. 1.

Ophiura squamosa Lütken. 1857. Grønlands Echinod. p. 50.
— — — 1858. Additamenta ad historiam Ophiu-

ridarum. I. K. D. Vid. Selsk. Skr. 5. R. V. p. 46. Tab. I. Fig. 7 a. b.

Ophioglypha robusta Lyman. 1865. Ophiuridæ and Astrophytidæ. Illustr. Catalogue Mus. Comp. Zool. I. p. 45.

— — Duncan & Sladen. 1881. Mem. Echinod. Arct. Sea. p. 62. Pl. IV. Figs. 5—7.

— — Fischer. 1886. Echinodermen. Oesterreich. Polarstat. Jan Mayen. p. 36.

Ophiura — Grieg. 1900. Ophiuriden d. Arktis. Fauna Arctica. p. 262.

Ophioglypha — Rankin. 1901. Echinoderms coll. off the West Coast of Greenland. p. 176.

— — 1903. Echinoderms from East Greenland. p. 83.

Ophiura — Michailovskij. 1903. Echinod. Russ. Exped. Spitzbergen. p. 31, 72.

Ophioglypha — Clark. 1904. Echinoderms of the Woods Hole Region. p. 558. Pl. 6. Figs. 31—32. Pl. 7. Figs. 39—40.

Ophiura — Grieg. 1907. Echinodermata. II. "Fram" Expedition. p. 18. Pl. I. Figs. 9—10.

Ophioglypha — Koehler. 1909. Échinodermes. Monaco. XXXIV. p. 154.

A great number of specimens of all sizes has been collected on the following stations: 20, 21, 25, 27, 53, 57, 60, 61, 63, 66—72, 95, 96.[1]

In some of the larger specimens the space between each pair of inner tentacle pores is more or less completely covered by small papillæ (Pl. XVI. Fig. 1). — In a specimen from Stat. 20, with the mouth abnormally developed, I found one of the mouth-tentacles dichotomously branched.

On the ventral side of the disk of a specimen from Stat. 71 was found a Halacarid; this occurrence probably is only accidental, still one cannot ascertain that definitely, so I have thought it right just to mention the case.

17. **Ophiocten sericeum** (Forbes).

Ophiocten Krøyeri Lütken. 1857. Grønlands Echinod. p. 52.

— — — 1858. Additam. ad hist. Ophiuridarum. I. p. 52. Tab. I. Fig. 5 a—d.

— — Lyman. 1865. Ophiuridæ and Astrophytidæ. p. 53.

— *sericeum* Duncan & Sladen. 1881. Mem. Echinod. Arctic Sea. p. 65. Pl. IV. Figs. 8—10, 14.

— — Grieg. 1892. Grønlandske Ophiurider. Bergens Mus. Årbog. p. 8.

[1] For the localities of the stations see the list p. 300.

Ophiocten sericeum Grieg. 1893. Ophiuroidea. Norske Nordhavs Exp. p. 9.
— — Grieg. 1903. "Michael Sars". Ophiuroidea. p. 26.
— — Michailovskij. 1903. Echinod. Russ. Exped. Spitzbergen. p. 33.
— — Kalischewskij. 1907. Echinodermenfauna d. sibir. Eismeeres. p. 17. Tab. I. Fig. 14 a—e.
— — Koehler. 1909. Échinodermes. Monaco. XXXIV. p. 166.

Several specimens, of different sizes, from Stations: 20, 21, 25, 32, 53, 57, 60, 61, 67, 70, 99.

Some of the specimens from Stat. 57 (Danmarks Havn, 15—20 m, $^{8}/_{7}$ 07) have ripe sexual products.

18. Ophiopus arcticus Ljungman.

Ophiopus arcticus Ljungman. 1866. Ophiuroidea viventia huc usque cognita. Öfvers. Vet. Akad. Förhandl. p. 309.
Ophiaregma abyssorum G. O. Sars. 1872. Bidrag til Kundskaben om Dyrelivet paa vore Havbanker. Vid. Selsk. Forhandl. Christiania. p. 112.
Ophiopus arcticus Grieg. 1892. Grønlandske Ophiurider. p. 9.
— — — 1893. Ophiuroidea. Norske Nordh. Exp. p. 17. Pl. II. Figs. 13—17.
— — Th. Mortensen. 1893. Über Ophiopus arcticus (Ljungman), eine Ophiure mit rudimentären Bursæ. Zeitschr. f. wiss. Zool. LVI. p. 506. Taf. XXV—XXVI.
— — Grieg. 1900. Ophiuriden d. Arktis. Fauna arctica. p. 266.
— — Grieg. "Michael Sars". Ophiuroidea. p 30.

Stat. 96 (76$^{3}/_{4}$° N. 18° W.) 160—178 m. 2 small specimens.
— 104 (76° 6′ N. 13° 26′ W.) 200—250 m. 1 small specimen.

19. Amphiura Sundevalli (M. Tr.).

Amphiura Holbølli Lütken. 1857. Grønlands Echinod. p. 52.
— — — 1858. Additam. ad hist. Oph. I. p. 55. Tab. II. Fig. 13 a, b.
— — Lyman. 1865. Ophiuridæ & Astrophytidæ. p. 118.
— — Duncan & Sladen. 1881. Mem. Ech. Arctic Sea. p. 67. Pl. IV. Figs. 15—17.
— *Sundevalli* Grieg. 1900. Ophiuriden d. Arktis. p. 265.

Amphiura Sundevalli Michailovskij. 1903. Echinod. Russ. Exped. Spitzbergen. p. 34, 73.

Station 63. Stormbugt. 10—20m. 1 specimen.

20. **Ophiacantha bidentata** (Retz.).

Ophiacantha spinulosa Lütken. 1857. Grønlands Echinod. p. 53.
— — — 1858. Additam. ad hist. Oph. I. p. 65. Tab. II. Fig. 14 a—b.
— — Lyman. 1865. Ophiuridæ & Astrophytidæ. p. 23.
— — Duncan & Sladen. 1881. Mem. Ech. Arctic Sea. p. 68. Pl. IV. Figs. 11—13.
— *bidentata* Grieg. 1893. Norske Nordh. Exp. Ophiuroidea. p. 22.
— — Grieg. 1900. Ophiuriden d. Arktis. Fauna Arctica. p. 267.
— — Grieg. 1902. Nordlige Norges Echinod. p. 13.
— — Th. Mortensen. 1903. Echinoderms from East Greenland. p. 86.
— — Michailovskij. 1903. Echinodermen Russ. Exp. Spitzbergen. p. 36.
— — Grieg. 1907. Echinodermata. II. "Fram" Exped. p. 21.
— — Koehler. 1909. Échinodermes. Monaco. XXXIV. p. 184. Pl. VI. Fig. 3.

Several specimens from Stations 9, 15, 57, 63, 64, 68, 71, 72, 95, 96, 99, 104.[1] One specimen (Stat. 63) is 4-rayed.

Several of the specimens (e. g. from Stations 15, 63, 96, 104) have ripe sexual products. The eggs are rich in yolk and large, ca. 0·8 mm in diameter. This large size may be taken as a nearly decisive proof that this species has not pelagic larvæ. The eggs in the same ovary are very different in size, from ripe to quite young, which fact is likewise in accordance with the suggested non-pelagic habit of the larvæ.

21. **Ophioscolex glacialis** M. Tr.

Ophioscolex glacialis M. Sars. 1861. Overs. Norges Echinod. p. 7. Tab. I. Fig. 6—7.
— — Grieg. 1893. Norske Nordh. Exp. Ophiuroidea. p. 27.
— — Grieg. 1900. Ophiuriden d. Arktis. Fauna Arctica. p. 268.

[1] For the localities of the stations see the list p. 300.

Ophioscolex glacialis Th. Mortensen. 1903. Echinoderms from East Greenland. p. 86. Pl. II. Fig. 10.
— — Michailovskij. 1903. Echinod. Russ. Exped. Spitzbergen. p. 37.
— — Grieg. 1909. Duc d'Orleans. Croisière océanographique de la "Belgica" dans la mer du Grønland. 1905. Invertébrés du Fond. p. 556.

Stat. 99 (77° N. $17^{1}/_{2}$° W.) 300 m. 2 beautiful specimens, the larger measuring 35 mm in diameter of the disk.

22. **Gorgonocephalus eucnemis** (M. Tr.).

Asterophyton eucnemis Lütken. 1857. Grønlands Echinod. p. 54.
— — — 1858. Additam. ad hist. Oph. I. p. 70. Tab. II. Fig. 17—19.
— — Lyman. 1865. Ophiuridæ and Astrophytidæ. p. 181.
— — Levinsen. 1886. Kara-Havets Echinod. p. 407. Tab. XXXV. Fig. 3—6.
Gorgonocephalus eucnemis Grieg. 1893. Norske Nordh. Exp. Ophiuroidea. p. 32. Pl. II. Fig. 18. Pl. III. Fig. 19.
— — Grieg. 1900. Ophiuriden d. Arktis. Fauna Arctica. p. 268.
— — Döderlein. 1900. "Olga" Echinodermen. p. 226. Taf. X. Fig. 1—4.
— — Michailovskij. 1903. Echinodermen Russ. Exp. Spitzbergen. p. 38.
— — Grieg. 1907. Echinodermata. II. "Fram" Exped. p. 22.
— — Koehler. 1909. Échinodermes. Monaco. XXXIV. p. 207.

Stat. 95. The Sound between "Renskær" and Maroussia, ca. 50—100 m, 2 large specimens.
— 96. ($76^{3}/_{4}$° N. 18° W.) 160—178 m. Several beautiful specimens, of different sizes.

Echinoidea.

23. **Srongylocentrotus drøbachiensis** (O. F. Müll.).

Echinus drøbachiensis Lütken. 1857. Grønlands Echinod. p. 24.
— — M. Sars. 1861. Overs. Norges Echinodermer. p. 95.
Strongylocentrotus drøbachiensis A. Agassiz. 1872. Revision of Echini. p. 277. Pl. IV, a. Figs. 2—4. Pls. IX—X.

Strongylocentrotus drøbachiensis Duncan & Sladen. 1881. Mem. Ech. Arctic Sea. p. 19. Pl. II. Figs. 1—3.
— — Ludwig. 1886. Echinodermen d. Beringsmeeres. p. 281.
— — Rankin. 1901. Echinoderms. West Greenland. p. 170.
— *chlorocentrotus* De Loriol. 1901. Notes pour servir à l'étude des Échinodermes. IX. p. 40. Pl. III. Fig. 5.
— *drøbachiensis* Grieg. 1902. Nordl. Norges Echinodermer. p. 32.
— — Th. Mortensen. 1903. "Ingolf" Echinoidea. I. p. 162. Pl. I. Figs. 5—6. Pl. II. Figs. 3—5. Pl. XVI. Figs. 4, 9, 11, 13, 17, 21, 23. Pl. XX. Figs. 3—6, 12—13, 16, 18, 20, 25, 26, 29.
— — Michailovskij. 1903. Echinodermen Russ. Exped. Spitzbergen. p. 13.
— — Clark. 1904. Echinoderms of the Woods Hole Region. p. 563. Pl. 9.
— — Döderlein. 1905. Arktische Seeigel. Fauna Arctica. p. 380.
— — Grieg. 1907. Echinodermata. II. "Fram" Exped. p. 23.

Several specimens from Stations: 20, 57, 58, 60, 63, 68, 69, 70, 71, 72, 96.[1]

In the "Ingolf" Echinoidea I. p. 120 I suggested that the *Strongylocentrotus chlorocentrotus* Brandt would prove to be distinct from *drøbachiensis*, founding my opinion mainly on a specimen in the collection of the Copenhagen Museum which might perhaps be the true *chlorocentrotus*. It is, however, said in conclusion that "nothing definite can be said of *Str. chlorocentrotus*, until the type specimen has been reexamined".

Recently Lambert & Thiéry (Notes Échinologiques. II. Sur les genres d'Échinides proposés par Brandt en 1835. Bull. Soc. Sci. nat. Haute-Marne. 1909. p. 38) maintain that "on ignore d'ailleurs ce que pouvait être exactement cet *E. chlorocentrotus*, insuffisamment décrit et d'origine inconnue. C'est sur une simple supposition de Postel qu'Al. Agassiz l'indique à Sitka, car Brandt nous dit "*patria ignota, locum enim natalem Mertensius non annotavit*"."

Wishing very much to have this matter settled through a renewed examination of the type specimen I wrote to the Director

[1] For the localities of the stations see the list p. 300.

of the St. Petersburg Museum, Professor Nassonow, asking him to lend me the specimen for examination. He most liberally granted my request sending me one of the three original specimens preserved in the Museum, informing me that the two other specimens were exactly in the same condition, viz. naked tests, without apical area. I have carefully compared the (large) specimen sent with equal sized specimens of *drøbachiensis*, the result being that I am unable to distinguish it from that species. Though it would have been very desirable to have examined also the pedicellariæ and spicules of the type of *chlorocentrotus*, I think it beyond doubt that it is really a synonym only of *drøbachiensis*, as maintained by A. Agassiz. That the specimen described by De Loriol (Op. cit.) under the name *Str. chlorocentrotus* is likewise only a local variation of the very variable *Str. drøbachiensis* seems to me likewise beyond doubt.

Holothurioidea.

24. **Myriotrochus Rinkii** Stp.

Myriotrochus Rinkii Steenstrup. 1851. En ny Form af de lungeløse og fodløse Søpølsers Gruppe. Vid. Medd. Nat. Foren. København. p. 55. Pl. III. Figs. 7—10.
— — Lütken. 1857. Grønlands Echinod. p. 22.
— — Théel. 1877. Note sur quelques Holothuries des Mers de la Nouvelle Zemble. N. Act. R. Soc. Upsal. Ser. III. p. 3. Pl. I.
— — Duncan & Sladen. 1881. Mem. Ech. Arctic Sea. p. 15. Pl. I. Figs. 20—24.
— — Danielssen & Koren. 1882. Norske Nordh. Exped. Holothurioidea. p. 28. Pl. V.
— — Levinsen. 1886. Kara-Havets Echinodermata. p. 387.
— — Ludwig. 1900. Arktische und subarktische Holothurien. Fauna Arctica. p. 160.
— — Östergren. 1902. The Holothurioidea of Northern Norway. Bergens Mus. Årbog. p. 14.
— — Michailovskij. 1903. Echinod. Russ. Exped. Spitzbergen. p. 12.

Several specimens, most of them badly preserved, from Stations: 16, 18, 43, 45, 46, 49, 70 and 72.

One specimen from Stat. 70, and another (small) specimen from Stat. 72 have only 11 tentacles, which appears to be a comparatively rare variation.

25. **Cucumaria frondosa** (Gunn.).
Pl. XVII. Figs. 9—10, 13.

Cucumaria frondosa Düben & Koren. 1844. Öfvers. Skand. Echinodermer. p. 293. Tab. IV. Fig. 1.
— *assimilis* Düben & Koren. 1844. Ibidem. p. 296. Tab. XI. Fig. 54. Tab. IV. Fig. 2.
— *frondosa* Lütken. 1857. Grønlands Echinod. p. 2.
— *minuta* (Fabr.) — — — — p. 7.
— *frondosa* Duncan & Sladen. 1881. Mem. Ech. Arctic Sea. p. 2. Pl. I. Figs. 1—2.
— — Bell. 1892. Catalogue of British Echinoderms. p. 39. Pl. IV. Fig. 2.
— — Ludwig. 1900. Arktische u. subarktische Holothurien. Fauna Arctica. p. 141.
— *minuta* Ludwig. 1900. Die Holothurien. In Döderlein. "Olga"-Echinodermen. p. 229.
— *frondosa* Ludwig. 1900. Ibidem. p. 229.
— — Michailovskij. 1903. Echinod. Russ. Exp. Spitzbergen. p. 4.
— *minuta* Michailovskij. 1903. Ibidem. p. 5.
— *frondosa* Clark. 1904. Echinoderms Woods Hole Region. p. 566. Pl. II. Figs. 65—66.
— *minuta* Grieg. 1909. Brachiopods and Molluscs, with a supplement to the Echinoderms. II. "Fram" Exped. 1898—1902. Nr. 20. p. 43.

Non. *Cucumaria minuta* Levinsen. Kara-Havets Echinodermata. p. 383. Tab. XXXIV. Figs. 1—3. (= *Cuc. glacialis* Ljg.).
— — G. Pfeffer. Echinodermen von Ost-Spitzbergen nach der Ausbeute der Herren Prof. W. Kükenthal u. Dr. A. Walter im Jahre 1889. Zool. Jahrb. Abt. f. Syst. VIII. 1895. p. 109.

Some large specimens from Stations 66, 71 and 95.[1]

In 1857 Lütken, in his "Oversigt over Grønlands Echinodermata", thought he had rediscovered the *Holothuria minuta* of Fabricius (Fauna Groenlandica Nr. 346) and gave a description of it, pointing out as the main characters distinguishing it from the young *Cuc. frondosa* that the "three series of tubefeet are more developed than the other two"; further that "the skin is rather closely covered with roundish plates which under the microscope prove to be of a somewhat undefined roundish shape, almost as Düben & Koren

[1] For the localities of the stations see the list p. 300.

figure them in *C. assimilis,* but with comparatively fewer and smaller holes." He was unable to state the number of the tentacles exactly.

Since the supposed rediscovery of this species by Lütken *Cuc. minuta* has constantly been mentioned in literature as a separate species, though sometimes a doubt as to its specific value has been expressed (Duncan & Sladen. Op. cit. p. 4. Michailovskij. Op. cit. p. 6). A more detailed account or examination of this form has, however, not been given (— the *Cucumaria minuta* described by Levinsen (Op. cit.) being quite a different species, *Cucumaria glacialis* Ljungman —), and the question of the validity of *Cucumaria minuta* is as yet undecided.

As long ago as in 1892 I made a critical examination of the matter and came to the result that Lütken's *Cucumaria minuta* was nothing but the young *Cuc. frondosa.* This study was, however, never published. The question having not been taken up meantime by any other author, I have thought it right to use this occasion to publish the results of my previous studies, finding on a renewed examination of the whole material that the conclusion, arrived at then, was quite correct.

A comparison of Lütken's specimens of *Cuc. minuta* with equal sized young specimens of *Cuc. frondosa* shows that they agree in all respects. Also in the young *C. frondosa* the dorsal radii have fewer tubefeet than the ventral, as is also generally the case in the large specimens (Michailovskij. p. 6). The calcareous plates of the skin are alike. As is well known, they occur in very variable numbers in the larger specimens of *C. frondosa*, and this also holds good for the young, though to a less degree. In the young specimens they are generally rather large and occur in comparatively great numbers, so as to cover the whole skin, and even, in strongly contracted specimens, to lie somewhat imbricated; in some specimens they are, however, small and less numerous or even very scarce, all gradations occurring so that it is quite impossible to find any specific feature in the greater or smaller number of the calcareous corpuscles or in the size of these corpuscles. Their structure is the same, whether they are large and numerous or small and scarce.

The number of the tentacles is 10 — also in the specimens in which Lütken was unable to count them. (Unfortunately Lütken's 3 specimens have by a mistake been put in a jar together with some other young *C. frondosa* from Greenland, so that it is impossible now to state exactly which of them are Lütken's specimens; but it is certain that these 3 specimens are among them, and as all the specimens in the jar have 10 tentacles, this must necessarily be the case also with Lütken's specimens).

The internal anatomy does not show any differences either. In short: there cannot be the slightest doubt that the *Cucumaria minuta* described by Lütken is really the young of *Cuc. frondosa.* A specimen from Maine (Packard 1861), identified by Lütken as *Cuc. minuta,* is also a young *C. frondosa.* That *C. minuta* has nothing to do with *Cuc. glacialis* Ljungm., as Kalischewskij (Op. cit. p. 3) is still inclined to think, suggesting that *C. glacialis* "nur eine gigantische Kaltwasser-Varietät von *Cucumaria minuta* (Fabricius) darstellt", seems to me superfluous to discuss in a more detailed manner, *C. glacialis* being in several respects (calcareous corpuscles, viviparity etc.) very different from *Cuc. frondosa* (*minuta*).

Quite recently Grieg (Op. cit.) has identified a young Holothurian from the II. "Fram" Expedition as *Cuc. minuta,* without expressing any doubt about the distinctness of the species. Wishing very much to examine this specimen I applied to Mr. Grieg about it, and he most liberally sent me the specimen for examination. I must state, after having carefully examined it, that I am unable to distinguish it from the young *C. frondosa.* What makes this specimen at the first glance look rather different from *C. frondosa* is the fact that it is white, whereas the young *C. frondosa* is generally more or less brownish in preserved state. But some of the available young specimens are very nearly white, and all intergradations in colour are found between these and the darkest specimens. I must then suppose that this difference in the colour is due either to individual variation [1] or perhaps only to the preservation. The calcareus corpuscles of the said specimen are exactly like those of *C. frondosa;* in short — though I have not opened the specimen — I cannot doubt that it is really *C. frondosa.*

The specimens of *C. minuta* recorded from Spitzbergen by Ludwig in his List of the Holothurians of the "Olga"-Expedition (Stat. 17) likewise are young specimens of *C. frondosa,* as I can state, the specimens having been lent me for examination from the Biological Station, Helgoland. I have further received for examination the specimens of "*Cucumaria minuta*" preserved in the Hamburg and Berlin Museums. Those from the Hamburg Museum (Ost Spitzbergen, Kükenthal, 1889) proved to be altogether *Cuc. glacialis,* while those from the Berlin Museum are partly *Cuc. glacialis* (Ost Spitzbergen, 1 specimen), partly *Cuc. frondosa* (St. 49. Römer u. Schaudinn. Cf. Ludwig. Arktische u. Subarkt. Holothurien. Fauna

[1] Dr. Hj. Östergren kindly informs me that he has seen white, grown specimens of *C. frondosa.* It is then possible that the present specimen may be an albino.

Arctica. p. 144). Upon the whole I think then we can safely assert that what has been recorded as *Cuc. minuta* will prove to be either *Cucumaria glacialis* or young specimens of *Cucumaria frondosa*.

The question still remains, whether Lütken was right in identifying his specimens with the *Holothuria minuta* of Fabricius. I think he was not. Fabricius' statement that it has 12 tentacles does not agree with Lütken's supposition; further, the drawing reproduced by Lütken (loc. cit.) seems to show a double circle of tentacles. These facts would suit much better to the young *Phyllophorus pellucidus* (*Orcula Barthii*). It is true, this species has 15 tentacles, not 12 as stated by Fabricius; but it is certainly more easily understood that Fabricius has seen only 12 tentacles in a species where the normal number is 15 (some of the tentacles may have been smaller than the others, as is not seldom the case in *Phyllophorus*, according to Östergren) than that he should have counted 12 tentacles in a species which has only 10. — Fabricius also does not state anything about the two radii having fewer tube-feet than the three others, in accordance with the fact that in the young *Phyllophorus* the radii are equally developed. One more fact speaks for the supposition that *Holoth. minuta* Fabr. is the young *Phyllophorus pellucidus*, namely its habits. According to Fabricius it is found "under stones on sandy bottom, burrowing in the ground, though not fixed, but free". This burrowing habit decidedly suits better to *Phyllophorus* than to *Cuc. frondosa*.

It is thus very probable that *Holothuria minuta* Fabricius is the young *Phyllophorus*. The definite proof cannot be given at present; but it would probably be rather easy to find in suitable Greenland localities specimens living in the sand under stones, as described by Fabricius, and thus to settle the question definitely. For the present we must rest satisfied with the statement that it is certainly no separate species, but probably identical with *Phyllophorus pellucidus* (*Barthii*).

In the place quoted (p. 9) Lütken mentions another young *Cucumaria* resembling a young *C. frondosa*, but having small calcareous corpuscles in the skin. There can be no doubt that this is likewise *C. frondosa*.

Lütken refers to *Cucumaria assimilis* Düb. & Kor. as a species which ought to be compared with *C. minuta*. Ludwig (Arkt. u. subarkt. Holothurien. Fauna Arctica. p. 148) regards this species as a synonym of *Cuc. lactea* (Forbes). In my opinion it can scarcely be doubted that it is really synonymous with *C. frondosa*. The calcareous corpuscles agree exactly with those of *C. frondosa*, whereas they differ considerably from those of *C. lactea*, as is well represented

by Düben & Koren. As a character of *C. assimilis* it is pointed out by Düben & Koren that two of the tentacles are smaller than the rest, and this has probably been the main reason for Ludwig's uniting it with *C. lactea*, in which likewise two of the tentacles are smaller than the rest; but also in young *C. frondosa* the two tentacles may sometimes be smaller, as I have been able to determine in some cases. This feature is then no proof against *C. assimilis* being a young *C. frondosa*. Also the whole shape of the animal, as represented by Düben & Koren, is much more like the young *C. frondosa* than *C. lactea*. Finally it is scarcely justifiable to suppose that Düben & Koren might mistake the young *C. lactea*, which species they knew and described very well, while it is easily understood that they could doubt, whether it was really *C. frondosa*, since they did not know the true calcareous corpuscles of that species.

The calcareous corpuscles of *Cuc. frondosa* have been figured by Bell (Op. cit. Pl. IV. Fig. 2). As these figures seem to me partly less satisfactory, I have given a figure of such a corpuscle (Pl. XVII. Fig. 10). They are generally angular, rather thick, with round holes, irregularly arranged, and between the holes are seen small prominences, which appear as small clear spots in the calcareous matter when viewed from above. In side view they are seen to be short tubercle-like prominences, as is well shown by Bell. As these calcareous corpuscles are generally very scarce or even totally wanting in the grown specimens, while they are mostly numerous in the young ones, they must probably be absorbed during growth; in fact, it is not rare to find small, irregular pieces of calcareous corpuscles in the skin of larger specimens, which may probably represent absorption-stages. Sometimes, however, one may also find some few developmental stages of calcareous corpuscles in larger specimens. Generally the calcareous corpuscles have disappeared already in specimens of ca. 20 mm length (in preserved, contracted stage). The spicules of the tubefeet, as well as the plate of the sucking disk, are generally not resorbed during growth. The shape of the disk plate is very irregular; it is very weak, and the holes large and irregular. In Pl. XVII. Fig. 9 is represented the disk from a young specimen, which is seen to consist of three separate plates.

In Pl. XVII. Fig. 13 is represented part of the calcareous ring of a specimen 10 mm long. The radialia are somewhat widened in the anterior part, which is hollowed in the middle, where the muscle is attached; the anterior edge is slightly sinuated. The interradialia are somewhat larger, with a narrow anterior part. The parts of the calcareous ring are, upon the whole, very weak and little developed

in the young specimens, in accordance with the more or less total disappearance of the calcareous ring in the grown specimens.

26. **Phyllophorus pellucidus**, var. **Barthii** (Troschel).

Pl. XVII. Figs. 3—7.

Orcula Barthii Lütken 1857. Grønlands Echinod. p. 9.
— — Duncan & Sladen. 1881. Mem. Ech. Arctic Sea. p. 8.
Phyllophorus pellucidus (Fleming), varietas *Barthii* (Troschel). Kalischewskij. 1907. Echinodermen-Fauna d. Sibir. Eismeeres. p. 5. Taf. I. Fig. 4 a—e.

Stat. 63. Stormbugt, 10—20 m. 1 specimen, measuring 8 mm, to the base of the tentacles.

That the "genera" *Orcula* and *Thyonidium* cannot be kept distinct from *Phyllophorus* I quite agree with Dr. Östergren. The question of the northern Atlantic species: whether we may distinguish 3 species (*pellucidus*, *Drummondi* and *Barthii*), or whether it is altogether one species, needs further examination on a rich, well preserved material. I cannot here enter on such a study, especially as I have not sufficient material available, so I must content myself with giving some remarks on the specimen in hand, naming it preliminarily, as does Kalischewskij, *Phyllophorus pellucidus*, var. *Barthii*.

The tentacles, which are rather well extended, are 15, viz. an outer circle of 10 larger and an inner circle of 5 small ones. The tubefeet are arranged in 5 nearly regular, double rows, equally developed. No tubefeet have appeared in the interradia as yet. The skin contains numerous plates of the form typical in *Phyllophorus* (Pl. XVII. Figs. 3—6). The plate of the sucking disk (Pl. XVII. Fig. 7) differs somewhat from that of the grown specimens; the difference is due, probably, only to the age.

For the question about the northern *Phyllophorus*-species it will be of some value to notice that in typical specimens of "*Orcula Barthii*" I find numerous spicules in the skin of the hindmost part of the body; they are of the shape typical for *Phyllophorus*, but otherwise I find them more or less dissolved so that it is impossible to see exactly how their shape has been in all minor details. Another noteworthy fact is that there is in the collection of the Copenhagen Museum at least one specimen of the true *Phyllophorus pellucidus* from West Greenland (Sukkertoppen), with the skin full of the typical calcareous corpuscles. The number of tentacles of this specimen cannot be ascertained, as the whole anterior end of the animal is lacking.

In my report on the Echinoderms of the Amdrup Expedition ("Echinoderms from East Greenland". Medd. om Grønland. XXIX. 1903. p. 89) I have indicated *Trochostoma boreale* (Sars) as occurring at East Greenland (Flemming Inlet, 118 fms., Angmagsalik, 140 fms.); I followed Ludvig in regarding *Tr. arcticum* (Marenz.) with the varieties *parvum* Théel and *coeruleum* Théel as synonyms of that species, without having, however, studied the question more closely. On studying the geographical distribution of the Echinoderms of Greenland on the present occasion I was struck with the remarkable distribution of this species. In "Fauna Arctica" (Holothurien p. 161) Ludwig gives its distribution as follows: Florida Riff, Lesser Antilles, Portland (Maine); West of Norway, Finmark, Spitzbergen, Kara Sea, Sibirian Ice Sea, Point Barrow. He remarks that "an diesem Verbreitungsgebiete fällt auf, dass die Art an Grönland und Island zu fehlen scheint". Ch. L. Edwards (The Holothurians of the North Pacific Coast of North America collected by the Albatross in 1903. Proc. U. S. Nat. Museum. Vol. XXXIII. 1907. p. 53) gives the same distribution of the species (under the name of *Trochostoma oöliticum* (Pourtalès)), adding only a number of Pacific localities for it, so that its range is considerably extended (to lat. 50° N., Vancouver Island). Östergren (The Holothurioidea of Northern Norway. Bergens Mus. Årbog. 1902. p. 22) considers the species as arctic, remarking only that it is "to be met with far to the south, down to the 12° N., but only at great depths, where the water even within the tropics is cold".

On zoogeographical grounds it seems very unlikely that the specimens from Florida and the West Indies should be identical with the purely arctic *Tr. boreale* or *arcticum*. It is true that other Echinoderms widely distributed in the arctic seas, even circumpolar, go far down to the South (*Cribrella sanguinolenta*, *Ophiacantha bidentata* e. g.); but in such cases their distribution is continuous, while in the case of *Trochostoma boreale* the distribution is discontinuous, the species being not known from Iceland, the Arctic East Coast of Amerika, and at Greenland only from the East Coast. It was then with great satisfaction, that I observed that H. Lym. Clark in his great work "The Apodous Holothurians. A Monograph of the Synaptidæ and Molpadidæ" (Smiths. Contr. to Knowledge. XXXV. 1907) had come to the result that both *Tr. arcticum* and the variety *parvum* Théel must be regarded as separate species. The genus *Trochostoma* (together with *Ankyroderma*) being regarded as synonyms only of *Molpadia* (— in which I am inclined to agree with Clark —),[1]

[1] E. Hérouard in his paper "Sur les Molpadides de Norvège" (Bull. Inst. Océanographique. No. 177. 1910) again maintains *Trochostoma* as a separate genus.

the species *Trochostoma boreale* (Sars) as understood by Ludwig and by me in the paper quoted becomes = *Molpadia oölitica* (Pourtalès), *M. arctica* (v. Marenzeller) and *M. parva* (Théel).

Nevertheless Clark gives the same distribution for *Molpadia oölitica* as do Ludwig and Edwards for *Trochostoma boreale* (*oöliticum*). This result comes about through regarding *Tr. boreale* and *oöliticum* as synonyms, the latter being widely distributed along the North American East Coast, from the West Indies to New Foundland. Though I have not myself examined any specimen of the American *M. oölitica*, I would on zoogeographical grounds doubt its identity with *M. borealis*. I would venture to suggest that *M. oölitica* may perhaps be a zoogeographical parallel to *Echinarachnius parma*, occurring at both the Pacific and the Atlantic side of North America. (See below, p. 299).

On a renewed examination of the specimens from the Amdrup Expedition I find the three specimens from Flemming Inlet to be *M. arctica* (v. Marenzeller). The specimen from off Angmagsalik, which was taken together with the decidedly boreal or Atlantic species: [1] *Pentagonaster granularis*, *Ophiacantha anomala* and *Ophioscolex purpureus*, might beforehand be supposed to be one of the Atlantic species. It bears, in fact, a considerable resemblance to *M. Blakei* (Théel) but differs from that species in some points, among which the presence of anchors appears, according to the researches of H. Lym. Clark, to be the least important. Possibly it is a new species, but on account of the scanty material in hand, and in view of the great difficulties in distinguishing the species within this genus I prefer to regard it only as a variety of *M. Blakei*, to which species it is, in any case, most nearly related. I shall give here a a description of it, under the name of

Molpadia Blakei, var. **grönlandica** n. var.

The single specimen is 30 mm long, including the distinct caudal appendage, which is 5 mm long. Anal papillæ appear to be wanting. The 15 tentacles have one short digit on each side. The radial pieces of the calcareous ring with distinct bifurcate prolongation. The skin is thin, somewhat translucent, rough from the projecting spires of the calcareous corpuscles. The deposits of the skin are anchors and tables, but no phosphatic corpuscles.

The anchors, which are rather numerous, are of the usual shape, with two arms, slightly indentated on the outer side (Fig. 5a);

[1] Unfortunately the Expedition did not take the bottom temperature on the dredging stations. But the fauna on this station does not leave any doubt but that this was a warm-water station.

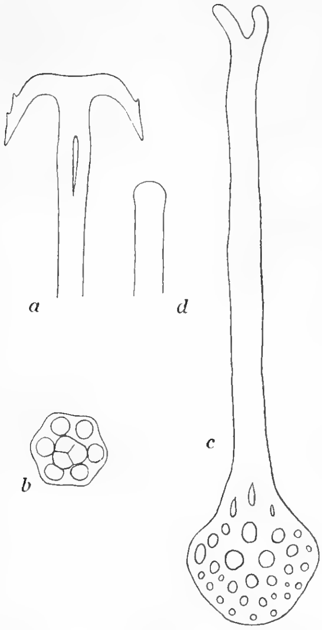


Fig. 5. Anchor plates of *Molpadia Blakei* var. *grönlandica*. *a*. Anchor; *b*. basal plate of the stalk, showing in the middle the stalk seen from above; *c*. supporting plate, abnormally divided in the end; *d*. normal end of a supporting plate. $^{110}/_{1}$.

the number of serrations cannot be stated with full certainty, the only sample preserved being a little dissolved, as is also the case with several of the other calcareous plates, the specimen having probably originally been preserved in formaline; but it seems that there was only one serration on one side, two on the other. The stalk is slightly widened below the arms and has here an elongate hole; whether this is a normal condition can, of course, not be ascertained from the single sample found. The basal disk of the anchor stalk (Fig. 5 b) is simple, with six holes, the edge being slightly concave between them; in this view the stalk is seen to be composed of three coalesced rods. The 4—6 supporting rods of the anchors are slender, sometimes bifurcate in the outer end (Fig. 5 c—d).

The tables (Fig. 6) have mostly 3 round holes. The Fig. 6 a represents the typical shape of the tables; but they often are more or less irregular (Fig. 6 b); the outer edge may be somewhat concave, and there may be different outgrowths, which may coalesce in different ways, so that a fourth

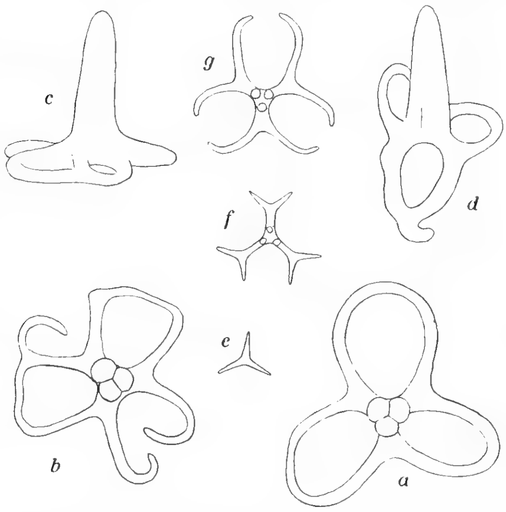


Fig. 6. Calcareous plates (tables) of the skin. *a*. the normal form; *b*. slightly irregular; *c*, *d*. side view of plates, showing the spire; *e*—*g*. developmental stages. $^{110}/_{1}$.

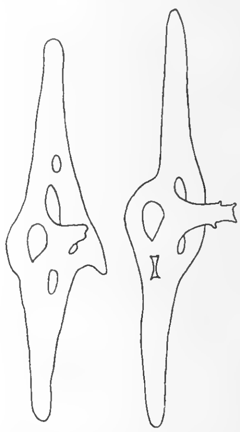


Fig. 7. Calcareous plates from the caudal appendage. $^{110}/_{1}$.

hole is formed; but the 3 original holes are always more or less easily recognizable. The spire consists of 3 rods, generally completely coalesced, slightly tapering and quite smooth (Fig. 6 c, d); in a few cases a small hole was found at its base. Among these plates are found, in rather great number, different stages of development (Fig. 6 e—g). The size of the plates is ca. 0·2—0·3 mm, the spire measuring ca. 0·17 mm. The supporting rods of the caudal appendage (Fig. 7) generally have 3—4 holes in the enlarged middle part, and generally a small, simple spire, consisting of three more or less completely coalesced rods; the spire may be slightly spinous.

Zoogeographical remarks on the Echinoderm-fauna of Greenland.

The first author to treat the zoogeography of the Echinoderms of Greenland was Lütken, who in his "Oversigt over Grønlands Echinodermata" 1857 gave a very careful study of this matter. It was a necessary consequence of the fact, that at that time the knowledge of the distribution of these animals was rather insufficient, that the results could not be very satisfactory. But the available material was, indeed, used in an excellent way. The Greenland fauna was compared with the neighbouring faunas, especially with that of North America and Scandinavia, while for want of knowledge that of the Siberian Ice Sea and the North Pacific could not be taken into account. It was tried to distinguish between the arctic and the boreal species — that the results do not always agree with our present views hereof, likewise depends on the insufficient knowledge at that time of both the distribution of the species and of the oceanography and hydrography of the northern Seas. The boundary between the arctic and subarctic region was sought, not in the Polar circle — as is done so much later in the "Fauna arctica" — but (in accordance with Dana) in the temperature, the "Isocrymal-line" 1·7° C. being taken as the limit, so that the Arctic region in the map accompanying the work nearly coincides with the region as it is now understood (cf. "Ingolf" Echinoidea. II. p. 179). — Upon the whole the question of the zoogeography of the northern Echinoderms could, at that time, scarcely have been better treated. —

Since Lütken published his study nobody has treated the zoogeography of the Echinoderms of Greenland specially; but through the works of more recent years: the "Ingolf" Expedition and the several expeditions to Greenland, last but not least the "Tjalfe" Expedition, further through the researches especially of Döderlein,

Grieg, Östergren, Michailovskij, Kalischewskij and the present author, on the northern Echinoderms, the knowledge of the fauna and its distribution, and of the oceanography and hydrography of the northern Seas has been so very considerably extended that it now seems possible to clear up the zoogeographical relations of this fauna, at least in its main features.

It may prove useful as an introduction to this study to give a short summary of the hydrography of the Greenland Seas.

The great depths of the Atlantic continue northwards on each side of Greenland to about Lat. 66° N. Here a submarine ridge forms the boundary between the Atlantic Deep-Sea and the Northern or Polar Deep-Sea. The ridge running across the Danmark Strait from Northwest Iceland in a northwestern direction to East Greenland separates the warm bottom water of the Atlantic from the ice-cold bottom water of the Polar basin. In the Davis Strait the ridge running from Holstensborg to Cape Walsingham on Baffin Land separates the great depths of the Davis Strait from the deep basin of Baffin Bay, thus stopping the passage northwards of the warm bottom water of the Atlantic Deep-Sea. The deep basin of the Baffin Bay is, on the other hand, limited to the North by the shallow water of Smith Sound. The Sea to the North of Greenland is still too little explored, but it seems probable that the great depths of the Sea North of Iceland are in direct continuation with the depths of the Polar Sea.

While thus the deep sea of Greenland is divided into two very distinct regions, a warm and a cold area, the conditions of the littoral regions are more complicated. Along the East Coast the great Polar Stream passes downwards, round Cape Farvel and then northwards along the West Coast, bringing with it the great ice masses and the cold polar water. Along the West side of the Davis Strait the cold Labrador Stream passes southwards, bringing the arctic conditions far down along the American coast and making its influence felt as far South as Cape Cod (about Lat. 42° N.). In the Danmark Strait the warm Atlantic water flows northwards along the West Coast of Iceland (the Irminger Stream); at the ridge it passes across the Danmark Strait towards the Greenland Coast and then passes southwards. The polar water, being less saline than the Atlantic water, occupies the upper layers of the sea, down to ca. 200 m. Its temperature is about 0°, while the Atlantic water has a temperature of 3° even down to 2000 m. At this part of the coast of East Greenland, from about Angmagsalik, and likewise along the West coast at least until the Holstensborg ridge, the influence of both a cold and a warm-water stream may thus be expected to be

traceable in the composition of the littoral fauna. The littoral fauna may be expected to be in the main purely arctic along the coast of Greenland, but below 200 m we may expect to find the Atlantic boreal fauna represented along the Southern Coast, from Angmagsalik to Holstensborg, or upon the whole as far as the influence of the warm Atlantic water makes itself sufficiently felt for making the conditions suitable to the boreal forms. This is exactly what occurs in regard to the Echinoderm fauna, as I shall try to show.

The total number of Echinoderms, littoral and deep-sea forms, known from Greenland is 72. In this number are included also those met with in the deeper parts of the Davis Strait and of the deep sea off the East Coast. The list of Echinoderms known from the Greenland seas is as follows:[1]

Crinoidea.

1. *Heliometra glacialis* (Leach).
2. *Hathrometra prolixa* (Sladen).
3. **Bathycrinus Carpenteri* Dan. Kor.

Asteroidea.

4. *Bathybiaster vexillifer* Wyv. Thomson.
5. *Pontaster tenuispinus* (Düb. Kor.).
6. ***Psilaster Andromeda* (Müll. Trosch.).
7. ***Leptoptychaster arcticus* (M. Sars).
8. *Ctenodiscus crispatus* (Retz.).
9. *Pentagonaster granularis* (Retz.).
10. ***Hippasteria phrygiana* (Parel.).
11. **Tylaster Willei* Dan. Kor.
12. *Poraniomorpha tumida* (Stuxb.)
13. *Solaster papposus* (L.).
14. — *squamatus* Döderl.
15. — *glacialis* Dan. Kor.
16. — *endeca* (L.)
17. — *furcifer* Düb. Kor.
18. **Korethraster hispidus* Wyv. Thoms.
19. *Pteraster militaris* (O. F. Müll.)
20. — *pulvillus* M. Sars.
21. — *obscurus* (E. Perr.).
22. *Hymenaster pellucidus* Wyw. Thoms.
23. *Cribrella sanguinolenta* (O. F. Müll.)
24. ***Pedicellaster typicus* M. Sars.
25. — *palæocrystallus* Sladen.
26. *Stichaster albulus* (Stimps.)
27. *Asterias Mülleri* (M. Sars).
28. — — var. *grønlandica* Stp.
29. — *polaris* (Müll. Trosch.)
30. — *panopla* Stuxb.
31. — *Linckii* (Müll. Trosch.)

Ophiuroidea.

32. *Ophiopleura borealis* Dan. Kor.
33. ** — *aurantiaca* (Verr.).
34. *Ophioglypha Sarsii* (Ltk.).
35. — *robusta* (Ayr.)

[1] The species marked * have only been recorded from the sea between Jan Mayen and East Greenland. The Swedish Zoological Polar Expedition 1900. (Östergren. Zool. Anzeiger. 1901. Nr. 642. p. 252). The species marked** have not hitherto been recorded from Greenland but there are specimens from there in the Copenhagen Museum (partly from the "Tjalfe" Expedition), about which I shall give information later on, in the reports of the "Ingolf" Expedition.

36. *Ophioglypha nodosa* (Ltk.).
37. — *Stuwitzii* (Ltk.).
38. *Ophiocten sericeum* (Forb.)
39. ***Ophiomusium Lymani* Wyv. Thoms.
40. *Ophiopholis aculeata* (O. F. Müll.).
41. ***Ophiactis abyssicola* M. Sars.
42. *Ophiopus arcticus* Ljungm.
43. *Amphiura Sundevalli* (M. Tr.)
44. *Ophiacantha bidentata* (Retz.).
45. — *anomala* G. O. Sars.
46. ** — *abyssicola* G. O. Sars.
47. *Ophioscolex glacialis* (M. Tr.).
48. — *purpureus* Düb. Kor.
49. *Gorgonocephalus eucnemis* (M. Tr.).
50. — *Agassizii* (Stimps.).

Echinoidea.

51. *Phormosoma placenta* var. *Sigsbei* (Agass.).
52. *Tromikosoma Koehleri* Mrtsn.
53. *Strongylocentrotus drøbachiensis* (O. F. Müll).
54. *Pourtalesia Jeffreysi* Wyv. Thoms.
55. — *Wandeli* Mrtsn.
56. *Aëropsis rostrata* (Wyv. Thoms.).
57. *Brisaster fragilis* (Düb. Kor.).

Holothurioidea.

58. *Myriotrochus Rinkii* Stp.
59. * — *Théeli* Östergr.
60. *Chirodota lævis* (Fabr.).
61. **Trochoderma elegans* Théel.
62. **Kolga hyalina* Dan. Kor.
63. ***Lœtmogone violacea* Théel.
64. *Molpadia arctica* (Marenzeller).
65. — *Blakei*, var. *grönlandica* Mrtsn.
66. *Eupyrgus scaber* Ltk.
67. *Cucumaria frondosa* (Gunn.)
68. — *calcigera* (Stimps.).
69. *Psolus Fabricii* (Düb. Kor.).
70. — *phantapus* (Strussenf.).
71. *Phyllophorus pellucidus* (Fleming.).

It may be concluded with certainty that still a considerable number of Atlantic Deep-Sea Echinoderms will be found in the deep parts of the Davis Strait and the Danmark Strait and thus belong, in some way, to the Greenland fauna. Likewise there can scarcely be any doubt that all the deep-sea Echinoderms of the Northern Sea will prove to occur off East Greenland, so that e. g. also *Elpidia glacialis* Théel will belong to the Greenland fauna. This, however, will not alter the main character of the fauna as it appears from what is known already. With the littoral Echinoderms the matter is different, it being very doubtful whether other species than those already recorded will ultimately be found at Greenland.

On dealing with the zoogeographical interrelations of the above named species we may first distinguish between the littoral and the abyssal species. In the “Ingolf” Echinoidea II (p. 178) I have, in agreement with A. Agassiz, defined the littoral region as going from 0—100 fathoms; the region from 100 to 500 fathoms is desig-

nated as the archibenthal region, and the depths below 500 fathoms as the abyssal region. This division seems very natural for the Greenland seas, the littoral region thus coinciding with the belt, where the polar water reigns. For the deep sea to the North of the Danmark Strait there is no reason for distinguishing both an archibenthal and an abyssal region, the fauna being of a rather uniform character below the littoral region; in the Davis Strait there may be reason to distinguish between the archibenthal and the abyssal region, though, upon the whole, these two regions are not nearly so sharply distinguished as is the littoral region from the two deep-sea regions. — It may be noticed that the species are here reckoned to the one or other region after their main occurrence; because a deep-sea species now and then occurs in the littoral region (or inversely a littoral species in the deep-sea regions) it is not counted among the littoral (or abyssal) species. The limits of the three regions are here rounded to 200 and 1000 m.

We may first take the deep-sea species, the problems connected with them being clear enough and easily understood. They are easily seen to form two quite distinct faunas, viz. an arctic abyssal fauna, occupying the deep sea to the East of Greenland, north of the ridge across the Danmark Strait, and an Atlantic abyssal fauna, occurring in the Davis Strait and probably round the whole of South Greenland, towards the ridge in the Danmark Strait.

The arctic archibenthal-abyssal fauna is represented by the following species:

Bathycrinus Carpenteri	*Ophiopleura borealis*
Pontaster tenuispinus	*Ophiopus arcticus*
Bathybiaster vexillifer	*Pourtalesia Jeffreysi*
Tylaster Willei	*Myriotrochus Théeli*
Korethraster hispidus	*Molpadia arctica*
Hymenaster pellucidus	*Kolga hyalina*

To these also *Elpidia glacialis* will probably have to be added. Several of these species also occur in places with warm bottom temperature (*Pontaster tenuispinus*, *Bathybiaster vexillifer*, *Korethraster hispidus*, *Ophiopleura borealis*, *Ophiopus arcticus*), but it seems to be mostly in the boundary regions between the cold and the warm area, where the temperature is more or less fluctuating.[1] *Pontaster tenui-*

[1] Grieg ("Michael Sars" Ophiuroidea. p. 13) is of opinion that the limit between the cold and the warm area is not represented by the temperature 0° but by that of + 2 or + 2·5°. I am not inclined to think this suggestion correct. We will have to recognize that some species are more eurytherm than others; this difference in their relation to temperature may well account for the differences in their distribution, some being restricted within the limits of the one or other area, while others may transgress these limits more or less extensively.

spinus and *Ophiopus arcticus*, however, are widely distributed also in the warm area, especially the former; according to Grieg ("Michael Sars" Asteroidea.) it is, however, possible to distinguish the specimens from the warm area as a separate variety. *Hymenaster pellucidus* is recorded also from the Azores (Perrier), but probably erroneously (Koehler. Monaco. XXXIV. 1909. p. 94). Upon the whole, all the above named species are typical cold-water forms.

The Atlantic abyssal fauna is represented by the following species:

Ophiopleura aurantiaca	*Tromikosoma Koehleri*
Ophiomusium Lymani	*Pourtalesia Wandeli*
Ophiacantha abyssicola	*Aëropsis rostrata*
Ophiactis abyssicola	*Brisaster fragilis*
Phormosoma placenta, var. *Sigsbei*	*Lætmogone violacea.*

To these will doubtless have to be added a considerable number of Atlantic Deep-Sea forms. The Davis Strait and the Danmark Strait are the direct continuations of the Atlantic Deep-Sea, a pair of large gulfs of the Atlantic, as it were; it is then not at all surprising to find here species occurring otherwise down to the West Indies, as e. g. *Phormosoma placenta,* var. *Sigsbei* and *Ophiomusium Lymani,* the latter species being known to occur also in the Pacific Ocean.

The difference between the Atlantic and the Arctic Deep-Sea faunas occurring in the Greenland Seas is distinct enough as seen by the two above lists. There is certainly some intermingling of the two faunas. Thus we may add *Pontaster tenuispinus* and *Ophiopus arcticus* to the list of the Atlantic species, and on the other hand *Ophiacantha abyssicola* and *Ophiactis abyssicola* might be added to the list of species of the Polar Sea, as both these species occur also within the cold area, especially the latter. But even if we agree that the three species: *Pontaster tenuispinus, Ophiopus arcticus* and *Ophiactis abyssicola* are really common to both the warm and the cold area (— that *Ophiacantha abyssicola* is a typical atlantic form, only just touching the borders of the cold area, is beyond doubt —), the difference between the fauna of the Polar and the Atlantic deep sea is very striking. It is an established fact that we have here two quite distinct faunas meeting in the deep waters off Greenland, just intermingling a little at the boundaries between their respective areas.

The fauna of the deep basin of the Baffin Bay is quite unknown as yet. It is still an unsolved problem, whether it is a branch of the Atlantic deep-sea fauna or is more related to the arctic abyssal

fauna. The third alternative — that it is a fauna peculiar to itself — is not very probable, in view of the comparative small area this basin occupies. The Polar Deep-Sea is so sharply separated from the Baffin basin through the shallow waters in Smith Sound and the other sounds to the North of Baffinland that a direct communication of the deep-sea fauna of the Polar Sea with that of the Baffin Sea is excluded. If a nearer relation between the deep-sea faunas of these two regions proves to exist it must be due to a more direct communication in a former period. Most probably, however, the fauna of this deep basin will prove to have been derived from the Atlantic fauna occurring in the Davis Strait. It has been proved through the researches of the "Tjalfe"[1] that below the cold surface water a bottom stream of warm Atlantic water (ca. 4° C.) passes northwards over the Holstenborg ridge into the Baffin Bay, making its influence felt at least as far North as the Umanak Fjord, where the bottom-temperature (at 700 m) is ca. 1° C. Probably the influence of this warm water will be felt over the whole of the Baffin basin, and in accordance herewith it may be suggested that the fauna will be derived from the Atlantic fauna of the Davis Strait.

The Atlantic archibenthal Echinoderm-fauna of Greenland is represented by the following species:

Psilaster andromeda	*Pedicellaster typicus*
Leptoptychaster arcticus	*Ophiacantha anomala*
Pentagonaster granularis	*Ophioscolex purpureus*
Hippasteria phrygiana	*Molpadia blakei,* var. *grönlandica.*

It is a prominent feature of this list that most of the species included occur in other places, especially at the Norwegian Coast, in considerably smaller depths than the 200 m here taken as the upper limit of the archibenthal region. Thus *Psilaster andromeda, Pentagonaster granularis, Hippasteria phrygiana* and *Pedicellaster typicus* are known there from so small a depth as 20 m, *Leptoptychaster arcticus* and *Ophioscolex purpureus* from ca. 60 m. At the Greenland coast, however, they are not known from above the 200 m line, and it seems fairly certain that they do not occur at all above that depth, viz. within the belt where the polar water makes its influence felt. They thus represent a very conspicuous Atlantic (boreal) element in the Greenland fauna. That these species occur at so low depths at the Norwegian coast is in accordance with the

[1] Ad. S. Jensen: Indberetning om Fiskeriundersøgelserne ved Grønland i 1908—1909. (Foreløbig Meddelelse om de fra Briggen "Tjalfe" foretagne hydrografiske Undersøgelser i Sommeren 1908—1909 ved J. N. Nielsen). Beretn. og Kundgørelser vedrørende Kolonierne i Grønland. Nr. 2, 5. 1909.

hydrographical conditions at this coast, the Gulf Stream making its influence felt here along the whole coast even so far North as Spitzbergen and the White Sea.

Among the littoral Echinoderms of Greenland there are several species which occur along the whole coast; for the study of the special relations of the fauna of Greenland these species are partly of minor importance. They are the following:

Heliometra glacialis	*Amphiura Sundevalli*
Hathrometra prolixa	*Ophiacantha bidentata*
Pteraster militaris	*Gorgonocephalus eucnemis*
Stichaster albulus	*Ophioglypha robusta*
Ctenodiscus crispatus	*Ophiocten sericeum*
Cribrella sanguinolenta	*Myriotrochus Rinkii*
Solaster papposus	*Cucumaria frondosa*
Strongylocentrotus drøbachiensis	

To these will probably be added:

Asterias Mülleri, var. *grønlandica*	Not known from North East Greenland.
Pteraster obscurus [1]	
Solaster furcifer	
Ophioglypha Sarsii	
Ophiopholis aculeata	
Gorgonocephalus Agassizii	
Eupyrgus scaber	

Ophioscolex glacialis, not known from North West Greenland.

Phyllophorus pellucidus, not known from the Angmagsalik Region.

Most of these species are widely distributed, even circumpolar. Some of them occur far to the South, thus e. g. *Cribrella sanguinolenta* and *Ophiacantha bidentata* are known also from the Azores and *Ctenodiscus crispatus* from the Gulf of Panama, and even so far South as 53° S.[2] along the South American West Coast. Sladen regarded the South American form as a separate species, *Ctenodiscus procurator*, but Ludwig thinks it cannot be distinguished from the northern species, *Ct. crispatus.* The fact that *Ct. crispatus* thus occurs along the whole Pacific coast of America is an argument in favour of A. H. Clarks "Polar-Pacific" region, which is taken to embrace "the Arctic and Antarctic seas and the entire Pacific coast of North

[1] Not hitherto recorded from the West Coast but a specimen was taken there by the "Tjalfe" Expedition.

[2] Ludwig. "Albatross"-Asteroidea. Mem. Mus. Comp. Zool. XXXII. 1905. p. 104.

and South America".[1] Even if *Ct. procurator* could be maintained as a distinct form, it would, through its near relation to *Ct. crispatus*, be of the same importance as argument for this remarkable uniting of the Arctic and the Antarctic into one region. A corresponding fact is perhaps found in the distribution of the species *Psolus squamatus* and *Ps. segregatus*, and perhaps even other Holothurians, while in the Echinoids no such instance appears to exist.

It is possible to distinguish an arctic and a boreal element among these species occurring round the whole coast of Greenland. Thus *Heliometra glacialis, Stichaster albulus, Pteraster obscurus, Strongylocentrotus drøbachiensis, Amphiura Sundevalli, Gorgonocephalus eucnemis, Myriotrochus Rinkii* and *Eupyrgus scaber* are decidedly arctic forms, *Solaster papposus, Cribrella sanguinolenta, Ophioglypha Sarsii, Ophiacantha bidentata* and *Phyllophorus pellucidus* boreal forms, while it may be difficult enough to state of the rest of them, whether they ought to be regarded as arctic or boreal.

The remainder of the littoral Echinoderms are of more restricted distribution along the Greenland coasts. The following species are known from the West Coast alone:

Asterias polaris	*Chirodota lævis*
— *Mülleri*	*Cucumaria calcigera*
Solaster endeca	*Psolus Fabricii*
Ophioglypha nodosa	— *phantapus*
— *Stuwitzii*	

From the East Coast alone are known:

Pteraster pulvillus	*Solaster glacialis*
Poraniomorpha tumida	— *squamatus.*

From the Northwest and East Coast alone are known:

Asterias Linckii
— *panopla*
Pedicellaster palæocrystallus.

It will be necessary to recall the distribution of each of these species separately.

Asterias polaris is known to occur only along the East Coast of North America, from Lat. 45° N. to Lat. 70° N., and at the West Coast of Greenland to at least 65° N. — According to Östergren[2] it is nearly related to *A. camtschatica* from the Bering Sea "und hat sich zweifelsohne von dort ostwärts nach Grönland verbreitet".

[1] A. H. Clark: The recent Crinoids and their relation to sea and land. The Geographical Journal. 1908. p. 603.
[2] Zool. Anz. XXVII. Nr. 19. 1904. p. 615.

Asterias Mülleri is not knovn from the American East Coast, but otherwise from the whole North Atlantic (Iceland, Færoes, Britain, North Sea and the Danish Seas); along the Norwegian Coast it passes to the Kara Sea, the Siberian Ice Sea and perhaps even to the Bering Sea. Fischer records it from Jan Mayen (Oesterr. Polarstat. Jan Mayen. 1886. p. 31). I would suggest that this is perhaps a mistake for the var. *grønlandica*. The typical *Ast. Mülleri* is, as seen by the distribution, decidedly a boreal form, though one of more eurytherm nature than other boreal species. Probably the temperature would not be a hindrance to its living at Jan Mayen, but as it is unknown at the North-East Coast of Greenland and at Spitzbergen, it seems very remarkable that it should have reached Jan Mayen, though — as is well known — it has not pelagic larvæ.

The distribution of the species *Solaster endeca, glacialis* and *squamatus* cannot be made out with full certainty as yet, these species having only recently been cleared up (through the researches of Döderlein and Grieg), while they were previously confounded under the names *S. endeca* and *papposus*. It is, however, evident that the species *glacialis* and *squamatus* are arctic species, probably developed in the Northern Sea, while *S. endeca* is a boreal species, though one which is not bound to the warm water. The fact that it reaches a larger size at the northern coasts of Norway than at the West Coast (Grieg. "Mich. Sars" Asteroidea. p. 66) seems to indicate that it prefers a somewhat low temperature, a fact in accordance with its occurrence in the littoral region of Greenland.

Pteraster pulvillus is evidently an arctic species, known from the arctic region of the East coast of North America, the East Coast of Greenland, Spitzbergen, the northern Coast of Norway and from the Siberian Ice Sea. It must be supposed to have developed in the Northern Sea. Its occurrence at North America may perhaps be accounted for by its having wandered round the South Coast of Greenland, across the Davis Strait (over the ridge?), in a former colder period. This would seem to be the natural explanation of its recent distribution in case it is really not found at the West Coast of Greenland (especially to the North). Our present knowledge of the fauna from the Baffins Bay northwards is, however, scarcely sufficient for proving definitely its non-existence in these waters.

Poraniomorpha tumida is likewise a purely arctic form, known only from the Polar Sea, from the East Coast of Greenland to the Siberian Ice Sea. It is not known from North America.

Pedicellaster palæocrystallus is hitherto known with certainty only from the northern Greenland, but it can scarcely be doubted

that it will prove to have a wider distribution in the Polar Seas. It must be supposed to have originated in this region.

Asterias panopla is known from the northern part of the West Coast and from the East Coast. It is further known from Spitzbergen and the Siberian Ice Sea, but not from the American East Coast. *A. Linckii* has a quite similar distribution, but it is also known from the American Coast (Nova Scotia). Both are purely arctic species. The wandering to North America of *A. Linckii* may be supposed to have taken place in the same way as with *Pteraster pulvillus*.

Ophioglypha nodosa is a circumpolar species, but it is not known from the northern West Coast or the East Coast of Greenland.

Oph. Stuwitzii is known only from the West Coast of Greenland and from the Arctic East Coast of North America, as is also the case with *Asterias polaris*.

Chirodota lævis[1] is circumpolar; it occurs on the East Coast of North America from 42° N. and along the whole West Coast of Greenland, but not on the East Coast.

Cucumaria calcigera occurs from the Bering Sea to the Kara Sea, but is not known from the Siberian Ice Sea; it is thus not circumpolar. Its distribution at North America and Greenland is as that of *Chirodota lævis*.

Psolus phantapus is a boreal type, but evidently an eurytherm form. It occurs along the Arctic East Coast of North America and at the West Coast of Greenland to 70° N. On the European Coasts it occurs from England and Denmark to Spitzbergen and the White Sea. Its distribution seems to agree with that of *Solaster endeca*. At the East Coast of Greenland it is not found. On the other hand it is recorded from Jan Mayen (Fischer. Op. cit. p. 38); this does not seem in accordance with its distribution as otherwise known, and from zoogeographical reasons I might venture to suggest that it is a mistake for *Ps. Fabricii*. This latter species is an arctic, circumpolar species. It is known from the Arctic East Coast of North America, from the West Coast of Greenland, but not from the East Coast.

After this revision it appears that the littoral Echinodermfauna of Greenland consists of at least three, perhaps four, different elements, viz. 1) endemic species, 2) At-

[1] In the Report of the Danish Biological Station. IX. 1899. p. 9, 10, 56. *Chirodota lævis* is recorded from the Skagerak. I take the occasion here to correct this statement, which rests on a wrong determination. I have examined some specimens from there and find them to be *Myriotrochus vitreus* (M. Sars). *Chirodota lævis* is not known from farther South than 67° 50′ Lat. N. (Grötö) at the European coast.

lantic, boreal species, 3) species belonging to the Northern Sea, and — perhaps — 4) species derived from the Northern Pacific.

The endemic species are *Asterias polaris* and *Ophioglypha Stuwitzii*, which are hitherto known only from the coasts of the Davis Strait, and which must be supposed to have originated in these waters. It is true that *Ast. polaris* is supposed by Östergren to have been derived from the Bering Sea; but so long as it is not proved to be identical with *A. camtschatica* or another Pacific species, we must take it as having developed in the Sea to the West of Greenland.

The Atlantic boreal fauna is represented by *Asterias Mülleri, Solaster endeca* and *Psolus phantapus*, to which must be added of those species occurring round the whole Coast of Greenland: *Solaster papposus, Cribrella sanguinolenta, Ophioglypha Sarsi, Ophiacantha bidentata* and *Phyllophorus pellucidus*. These species are eurytherm enough to be able to thrive in the littoral region of Greenland, while those named above as Atlantic archibenthal forms are less eurytherm, so that they do not appear to be able to endure the cold of the Polar water. Those occurring also at the East Coast are evidently the most eurytherm, as they can endure the highly arctic conditions of this coast.

The third group of species, those belonging to the Northern Sea, is the most important. It includes the species: *Solaster glacialis, S. squamatus, Pteraster pulvillus, Pt. obscurus, Poraniomorpha tumida, Pedicellaster palæocrystallus, Asterias panopla* and *A. Linkii*. To these may be added of the species occurring (or supposed to occur) round the whole Greenland Coast: *Asterias grønlandica, Stichaster albulus, Solaster furcifer, Ophiocten sericeum, Ophioscolex glacialis, Gorgonocephalus eucnemis* and *G. Agassizii*. They appear to have first reached the East Coast of Greenland and from there partly spread northwards or southwards (or both) along the coast, some of the latter reaching to the American Coast.

The group of species which may be supposed to have come from the Arctic Pacific contains the species: *Ophioglypha nodosa, Chirodota lævis, Cucumaria calcigera* and *Psolus Fabricii*, to which may probably be added some more widely distributed species: *Strongylocentrotus drøbachiensis, Heliometra glacialis, Pteraster militaris, Myriotrochus Rinkii, Phyllophorus pellucidus, Cucumaria frondosa.*[1]

[1] According to Ch. L. Edwards (Revision of the Holothurioidea. I. Cucumaria frondosa (Gunner) 1767, and Four species of Pacific Ocean Holothurians allied to Cucumaria frondosa (Gunner), Zool. Jahrb. Abt. f. Syst. Bd. 29. 1910), *Cuc. frondosa* does not occur in the Pacific. — These two important papers were received too late to be taken into account in the systematic part of this paper.

It seems probable that these species have wandered towards the East from the Pacific. This may be concluded from the fact that f. i. *Strongylocentrotus drøbachiensis* does not appear to have spread as yet to the Eastern Siberian Sea.

It is a very remarkable fact that so great a number of these species do not appear to have reached down along the East Coast of Greenland (Comp. p. 295). (— It can scarcely be supposed that they altogether have been overlooked there —). A reasonable explanation of this peculiar fact is difficult to find. In the development of these species it can scarcely be found (viz. in the presence or lacking of pelagic larvæ), since both forms with pelagic larvæ (*Strong. drøbachiensis*) and without such (*Pteraster militaris*) have found their way down along the East Coast. That the climatic conditions are too severe seems scarcely probable.

One thing is still worth noticing, viz. the absence of a few characteristic species: *Echinarachnius parma, Molpadia borealis* and *Cucumaria glacialis.* The latter is distributed from Spitzbergen to the Siberian Sea, at least to 172° E. It seems very remarkable that it has not reached Greenland along with the other species endemic in the Northern Sea; the same holds good for *Molpadia borealis*, which has nearly the same distribution.

The distribution of *Echinarachnius parma* is, however, more remarkable. It occurs in the Northern Pacific down to Vancouver Island, and along the Atlantic Coast of North America from Maine to Maryland. From the North Coast of America it is not known. The same appears to be the distribution of *Molpadia oölitica.* This distribution has probably been brought about through climatic oscillations. In a warmer period, such as has been proved by Ad. S. Jensen to have existed here (when *Zirphœa crispata* lived at the Greenland Coast)[1], they have probably been distributed along the whole of the American North Coast. When the temperature again lowered they disappeared from the northern regions, getting thus their recent discontinuous distribution. It would not seem improbable that they had at that time also reached the Greenland West Coast; there has, however, not hitherto been found remnants of *Echinarachnius* in the layers containing *Zirphœa crispata.* — At that warmer period the Atlantic species now only found in the archibenthal region have doubtless occurred much more littoral.

[1] Ad. S. Jensen. On the Mollusca of East Greenland. I. Lamellibranchiata. With an Introduction on Greenlands Mollusc-Fauna from the quaternary time. Medd. om Grønland, XXIX. 1905. — Ad. S. Jensen & Poul Harder. Postglacial Changes of climate in arctic regions as revealed by investigations on marine deposits. (Postglaziale Klimaveränderungen. Stockholm. 1910).

The polar water of the East Greenland Stream cannot then have had the powerful influence along the West Coast it has now, which is proved by the occurrence in the littoral region of *Zirphœa crispata* at that time. What influence this milder period has had otherwise on the distribution of the Greenland Echinoderms is not clear; it does not appear that any of the problems afforded by this distribution are solved by its means.

List of the Stations of the Danmark Expedition, where Echinoderms have been collected.

Station 9. 76° 8′ N. 10° 49′ W. 300 m. ($^{4}/_{8}$ 06).
Ophiacantha bidentata.

— 15. 76° 35′ N. 18° 26′ W. 150 m. ($^{14}/_{8}$ 06).
Ophiacantha bidentata.

— 16. 76° 47′ N. 18° 45′ W. ca. 10 m. Danmarks Havn. $^{17}/_{8}$ 06.
Stichaster albulus, Myriotrochus Rinkii.

— 18. Danmarks Havn. ca. 8 m. $^{24}/_{8}$ 06.
Myriotrochus Rinkii.

— 20. Danmarks Havn. 10—20 m. $^{19}/_{9}$ 06.
Ophioglypha robusta, Ophiocten sericeum, Strongylocentrotus drøbachiensis,

— 21. Danmarks Havn. 6—10 m. $^{20}/_{9}$ 06.
Stichaster albulus, Ophioglypha robusta, Ophiocten sericeum.

— 25. Danmarks Havn. 20 m. $^{25}/_{9}$ 06.
Stichaster albulus, Ophioglypha robusta, Ophiocten sericeum.

— 27. Danmarks Havn. 20—30 m. $^{29}/_{9}$ 06.
Stichaster albulus, Ophioglypha robusta.

— 32. Danmarks Havn. 12 m. $^{8}/_{10}$ 06.
Ophiocten sericeum.

— 36. Danmarks Havn. 10—15 m. $^{13}/_{10}$ 06.
Solaster papposus, Stichaster albulus.

— 43. Danmarks Havn. 6—10 m. $^{1}/_{7}$ 07.
Myriotrochus Rinkii.

— 45. Danmarks Havn. 6—12 m. $^{8}/_{7}$ 07.
Myriotrochus Rinkii.

Station 46. Danmarks Havn. 8—12 m. 15/2 07.
Myriotrochus Rinkii.

— 48. Danmarks Havn. 8—12 m. 18/7 07.
Stichaster albulus.

49. Danmarks Havn. 8—12 m. 21/7 07.
Stichaster albulus, Myriotrochus Rinkii.

— 50. Danmarks Havn. 8—12 m. 22/7 07.
Stichaster albulus.

— 53. Danmarks Havn. ca. 10 m. 25/7 07.
Stichaster albulus, Ophioglypha robusta, Ophiocten sericeum.

— 56. Danmarks Havn. 10—15 m. 28/7 07.
Stichaster albulus.

— 57. Danmarks Havn. 15—20 m. 8/8 07.
Cribrella sanguinolenta f. lævior, Ophioglypha robusta, Ophiocten sericeum, Ophiacantha bidentata, Strongylocentrotus drøbachiensis.

— 58. Danmarks Havn. 0—10 m. 10/8 07.
Stichaster albulus, Strongylocentrotus drøbachiensis.

— 60. Danmarks Havn. 5—20 m. 14/8 07.
Stichaster albulus, Ophioglypha robusta, Ophiocten sericeum, Strongylocentrotus drøbachiensis.

— 61. Danmarks Havn. 10—15 m. 15/8 07.
Stichaster albulus, Ophioglypha robusta, Ophiocten sericeum.

63. Stormbugt. 10—20 m. 20/8 07.
Heliometra glacialis, Cribrella sanguinolenta f. scabrior and *lævior, Pteraster militaris, Solaster papposus, Pedicellaster palæocrystallus, Stichaster albulus, Ophioglypha robusta, Amphiura Sundevalli, Ophiacantha bidentata, Strongylocentrotus drøbachiensis, Phyllophorus pellucidus,* var. *Barthii.*

— 64. Stormbugt, off Cap Helgoland. ca. 100 m. 22/8 07.
Solaster papposus, Ophiacantha bidentata.

— 66. Stormbugt. 30 m. 28/8 07.
Solaster papposus, Ophioglypha robusta, Cucumaria frondosa.

— 67. Danmarks Havn. 20—30 m. 29/8 07.
Ophioglypha robusta, Ophiocten sericeum.

— 68. Off Cap Bismarck. 40—60 m. 2/9 07.
Ophioglypha robusta, Ophiacantha bidentata, Strongylocentrotus drøbachiensis.

— 69. Stormbugt. 20—30 m. 2/9 07.
Stichaster albulus, Ophioglypha robusta, Strongylocentrotus drøbachiensis.

Station 70. Danmarks Havn. 20—30 m. 4/9 07.
Ophioglypha robusta, Ophiocten sericeum, Strongylocentrotus drøbachiensis, Myriotrochus Rinkii.

— 71. Off Cap Bismarck. 15—20 m. 4/9 07.
Pteraster pulvillus, Stichaster albulus, Ophioglypha robusta, Ophiacantha bidentata, Strongylocentrotus drøbachiensis, Cucumaria frondosa.

— 72. Stormbugt. 30 m. 10/9 07.
Cribrella sanguinolenta f. scabrior, Solaster papposus, Stichaster albulus, Ophioglypha robusta, Ophiacantha bidentata, Strongylocentrotus drøbachiensis, Myriotrochus Rinkii.

— 94. The sound at Cap Bismarck. ca. 30 m. 19/7 08.
Solaster glacialis.

— 95. The sound between Renskær and Maroussia. ca. 50—100 m. 19/7 08.
Ophioglypha robusta, Ophiacantha bidentata, Gorgonocephalus eucnemis, Cucumaria frondosa.

— 96. 76¾° N. 18° W. (off Maroussia). 160—178 m. 22/7 08.
Pedicellaster palæocrystallus, Ophioglypha robusta, Ophiopus arcticus, Ophiacantha bidentata, Gorgonocephalus eucnemis, Strongylocentrotus drøbachiensis.

— 98. 77° N. 18½° W. 300 m. 22/7 08.
Bathybiaster vexillifer, Ctenodiscus crispatus, Asterias panopla.

— 99. 77° N. 18½° W. 300 m. 22/7 08.
Heliometra glacialis, Hathrometra prolixa, Pontaster tenuispinus, Ophiopleura borealis, Ophiocten sericeum, Ophiacantha bidentata, Ophioscolex glacialis.

— 104. 76° 6′ N. 13° 26′ W. 200—250 m. 28/7 08.
Hathrometra prolixa, Poraniomorpha tumida, Cribrella sanguinolenta f. lævior, Ophiopus arcticus, Ophiacantha bidentata.

23—1 1911.

Plate VIII.

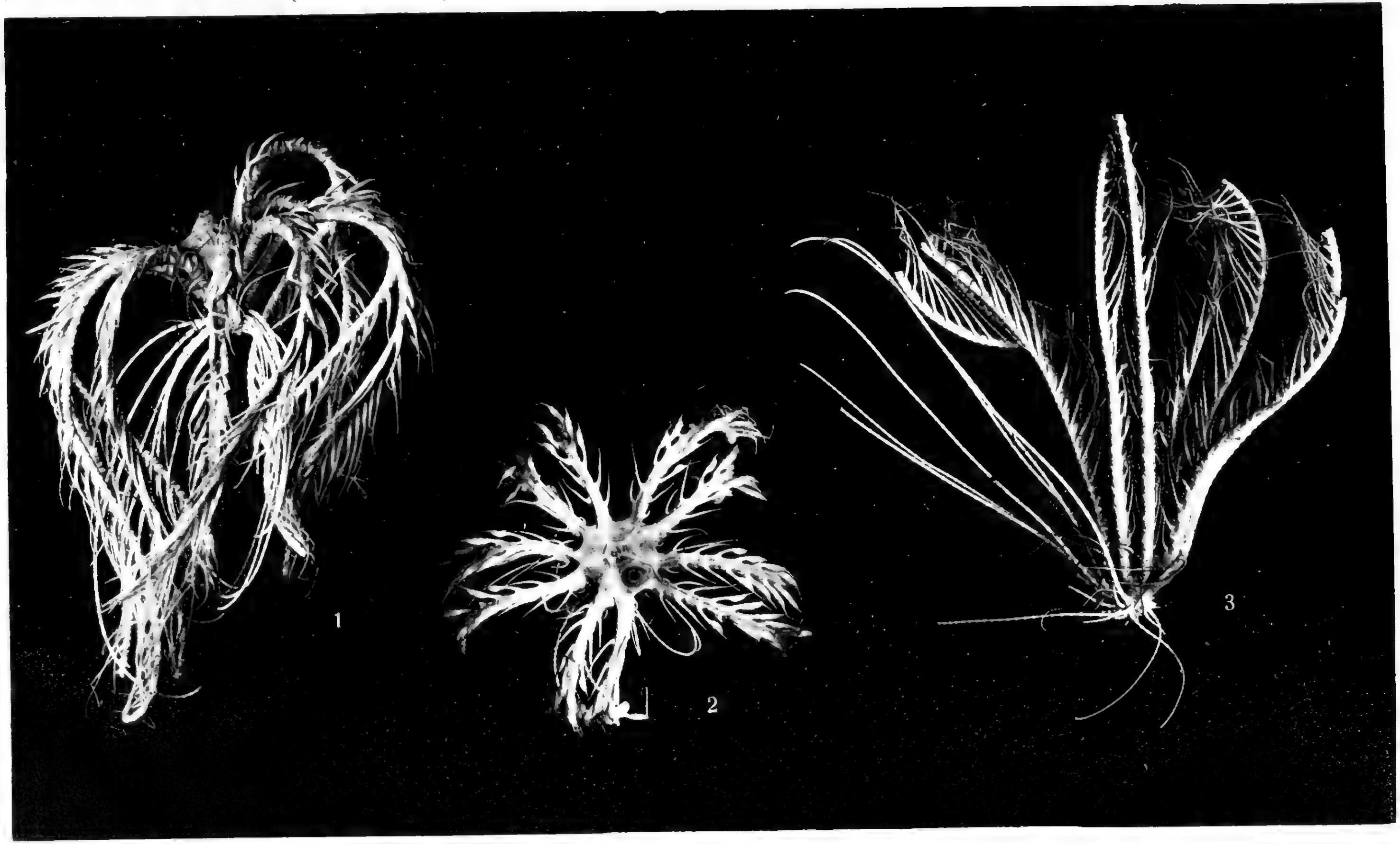
PLATE VIII.

Hathrometra prolixa (Sladen). All figures natural size.

Fig. 1. Side view.

— 2. Seen from the oral side.

— 3. Side view; on the middle of one of the long cirri to the left are seen two Pentacrinoids.



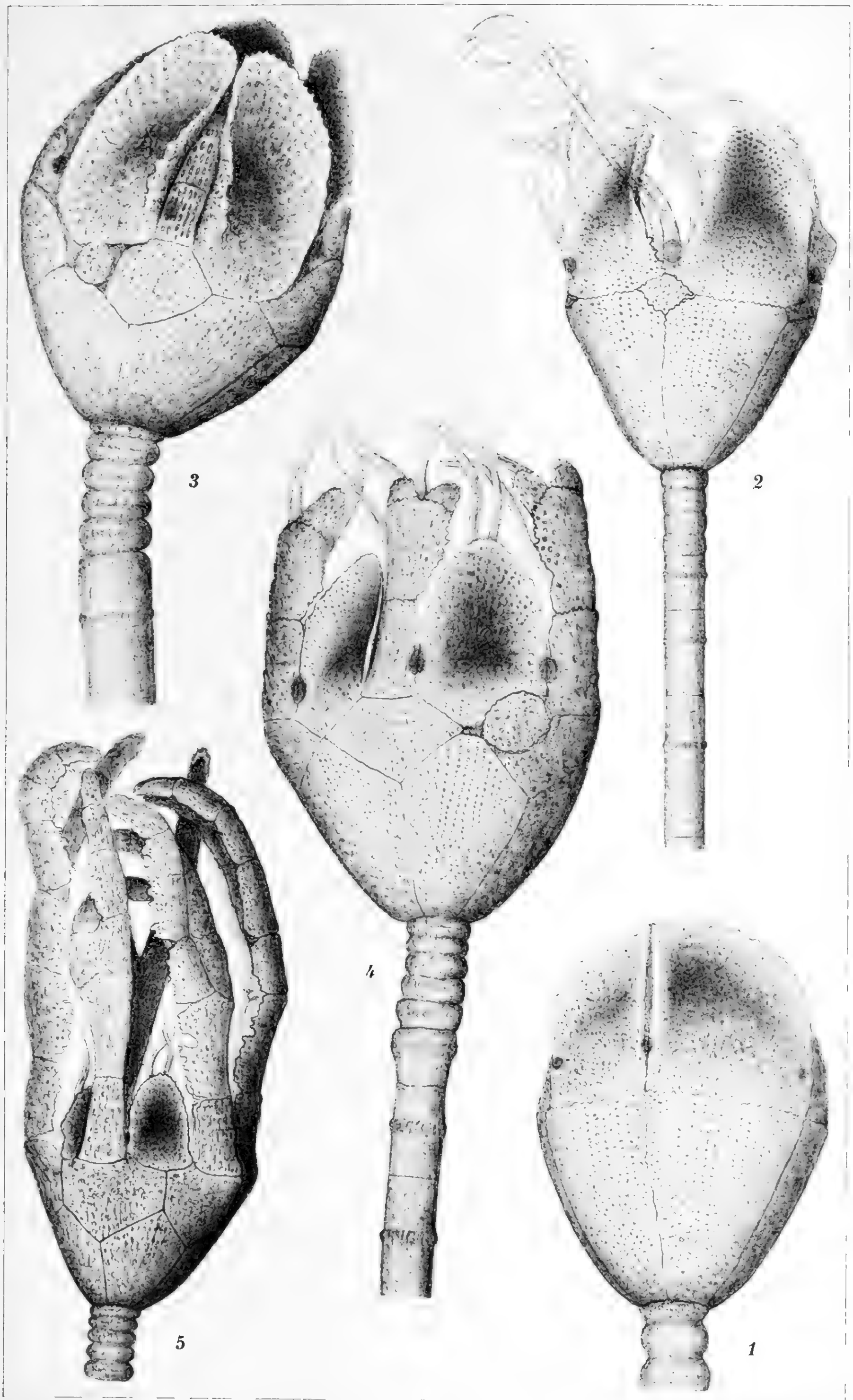
Pacht & Crone phototyp.

Plate IX.

PLATE IX.

All the figures represent the calyx and upper stalk joints of Pentacrinoid larvæ of *Hathrometra prolixa* (Sladen) in different stages of development.

Fig. 1. Stage I. $^{115}/_{1}$.
— 2. Stage II. The oralia are open and the oral tentacles protruding. $^{75}/_{1}$.
— 3. Stage III. $^{75}/_{1}$.
— 4. Stage IV. $^{75}/_{1}$.
— 5. Stage V. $^{50}/_{1}$.



Th. Mortensen del. *Pacht & Crone phototyp.*

Plate X.

PLATE X.

Fig. 1. Pentacrinoid larva of *Heliometra glacialis* (Leach). $^{25}/_{1}$.
— 2. — — - *Hathrometra prolixa* (Sladen), stage V. $^{16}/_{1}$.
— 3. — — - *Antedon petasus* (Düb. Kor.). $^{35}/_{1}$.

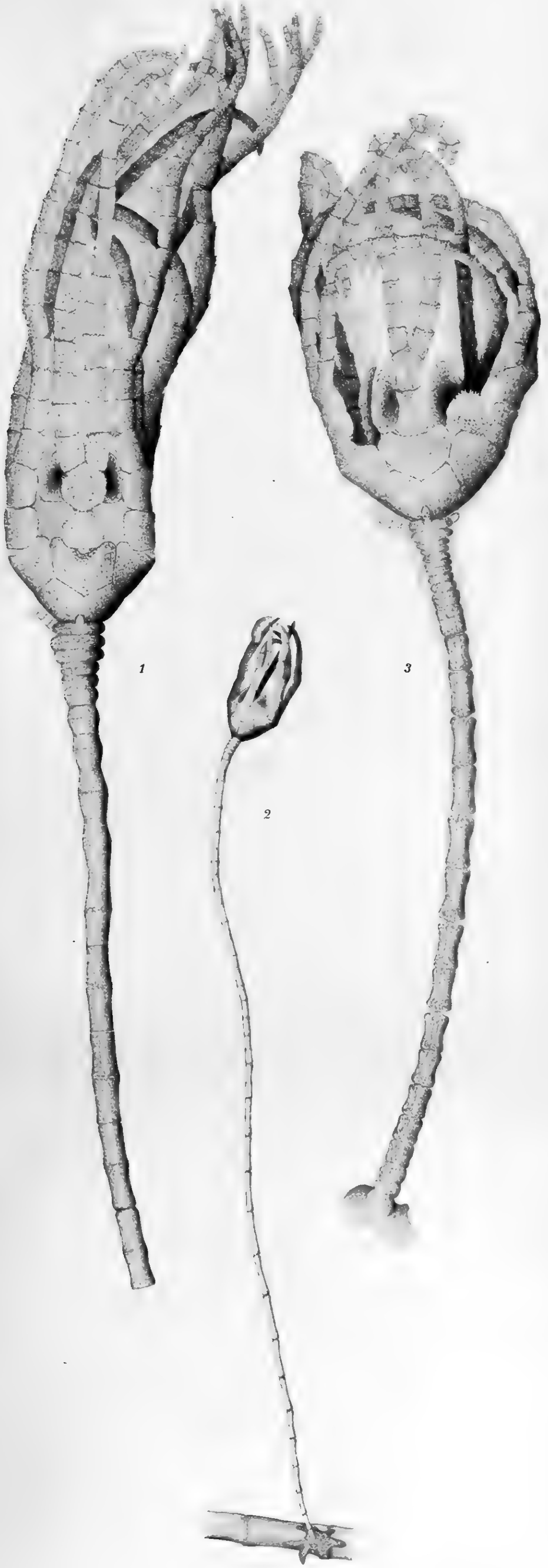


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Plate XI.

PLATE XI.

Fig. 1. Pentacrinoid larva, stage I, on cirrus joint, of *Hathrometra prolixa* (Sladen). $^{45}/_{1}$.

— 2. Basal plate and lower stalk joints of Pentacrinoid larva of *Hathrometra prolixa*, stage II. $^{75}/_{1}$.

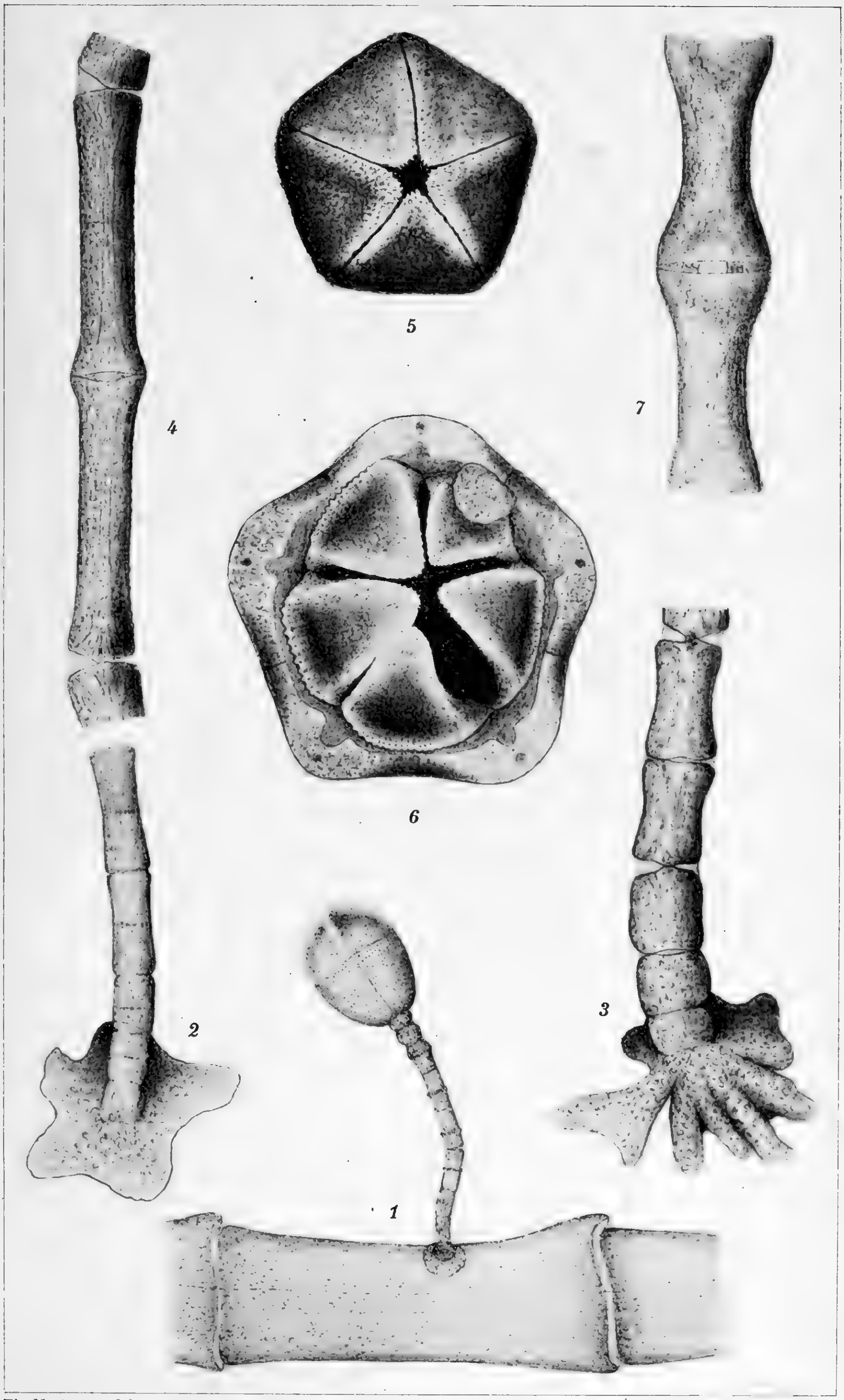
— 3. Basal plate and lower stalk joints of Pentacrinoid larva of *Hathrometra prolixa*, stage IV. $^{65}/_{1}$.

— 4. Stalk joints (Nos. 23—24 from above) of Pentacrinoid larva of *Hathrometra prolixa*, stage IV. $^{65}/_{1}$.

— 5. Calyx, seen from above, of Pentacrinoid larva of *Hathrometra prolixa*, stage I. $^{110}/_{1}$.

— 6. Calyx, seen from above, of Pentacrinoid larva of *Hathrometra prolixa*, stage IV. $^{65}/_{1}$.

— 7. Stalk joints, from the middle of the stalk, of Pentacrinoid larva of *Antedon tenella*. $^{65}/_{1}$.



Th. Mortensen del. Pacht & Crone phototyp.

Plate XII.

PLATE XII.

Fig. 1. Bifurcating pinnule of *Hathrometra prolixa* (Comp. Fig. 7). $^{7}/_{1}$.

— 2. Stalk joint of Pentacrinoid larva of *Hathrometra prolixa*, seen from above (Comp. Fig. 3). $^{115}/_{1}$.

— 3. Upper part of stalk joint of Pentacrinoid larva of *Hathrometra prolixa*, side view (Comp. Fig. 2). $^{115}/_{1}$.

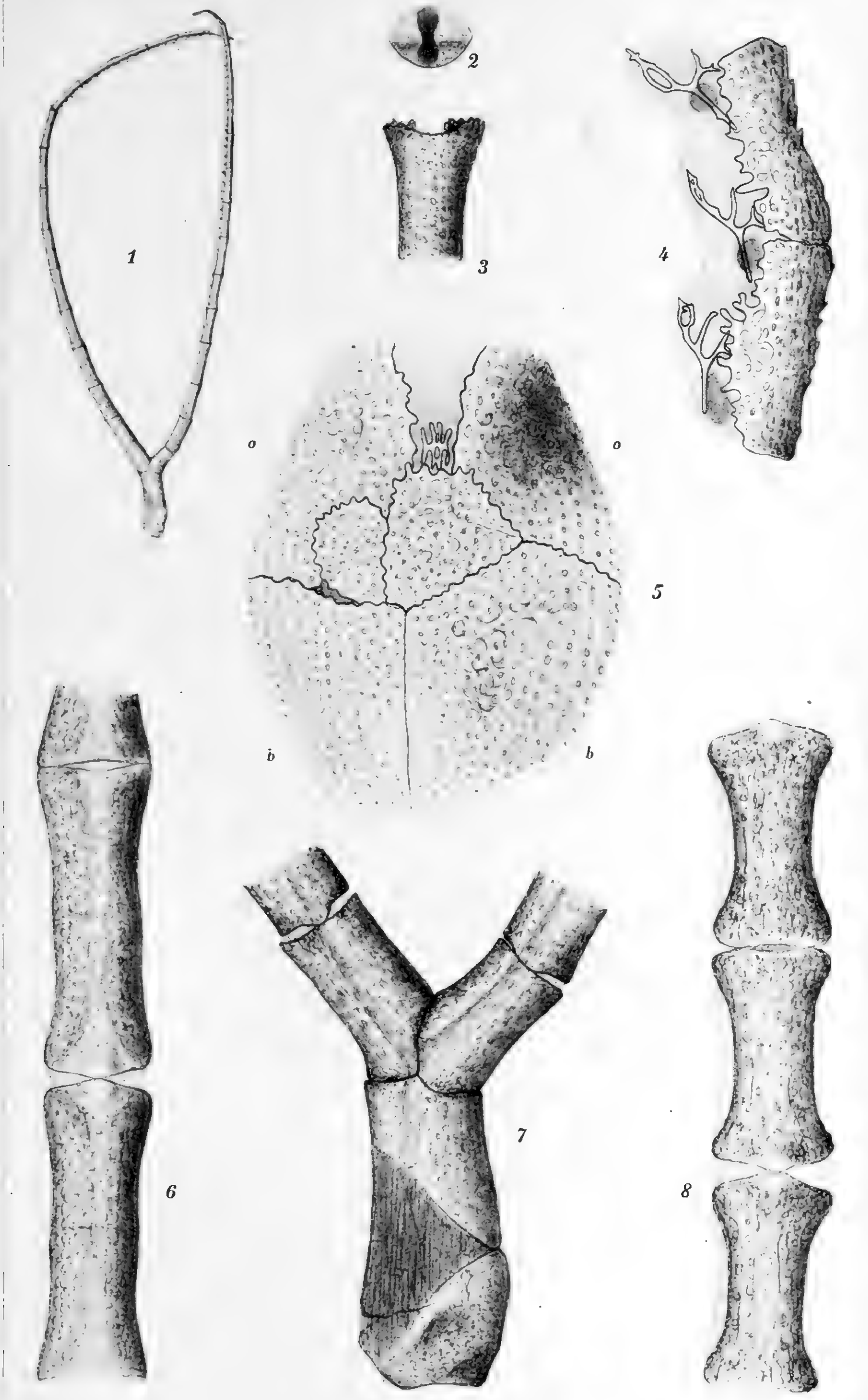
— 4. Arm joints of Pentacrinoid larva of *Hathrometra prolixa*, stage IV. Tentacles omitted. $^{115}/_{1}$.

— 5. Part of calyx of Pentacrinoid larva of *Hathrometra prolixa*, showing in the middle, where the oralia (*o*) and basalia (*b*) meet, the radial I and the anal plate; outside the radial I the first beginning of radial II is seen. $^{115}/_{1}$.

— 6. Stalk joints, from the middle of the stalk, of the Pentacrinoid larva of *Heliometra glacialis*. $^{65}/_{1}$.

— 7. Proximal part of bifurcating pinnule of *Hathrometra prolixa* (Comp. Fig. 1). $^{35}/_{1}$.

— 8. Stalk joints, from the middle of the stalk, of the Pentacrinoid larva of *Antedon petasus*. $^{105}/_{1}$.



Th. Mortensen del. Pacht & Crone phototyp.

Plate XIII.

PLATE XIII.

Figs. 1—6. *Stichaster albulus.* 1, 3, 4 and 6 represent specimens with abnormal reproduction of arms; 2 and 5 represent full-grown specimens. $^1/_1$.

— 7—8. *Ophiopleura borealis,* abnormal specimen; 7 ventral, 8 dorsal aspect. $^1/_1$.

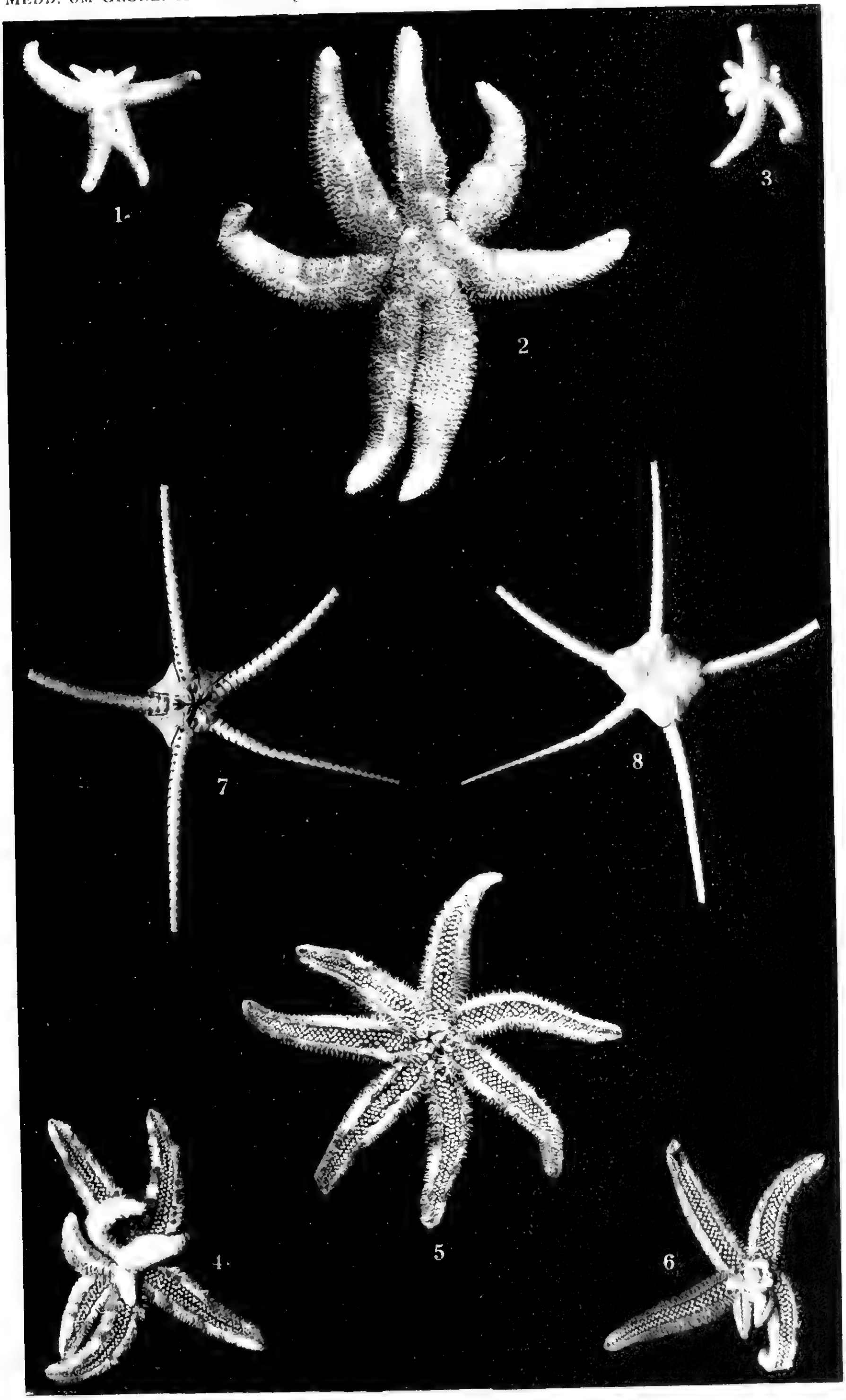


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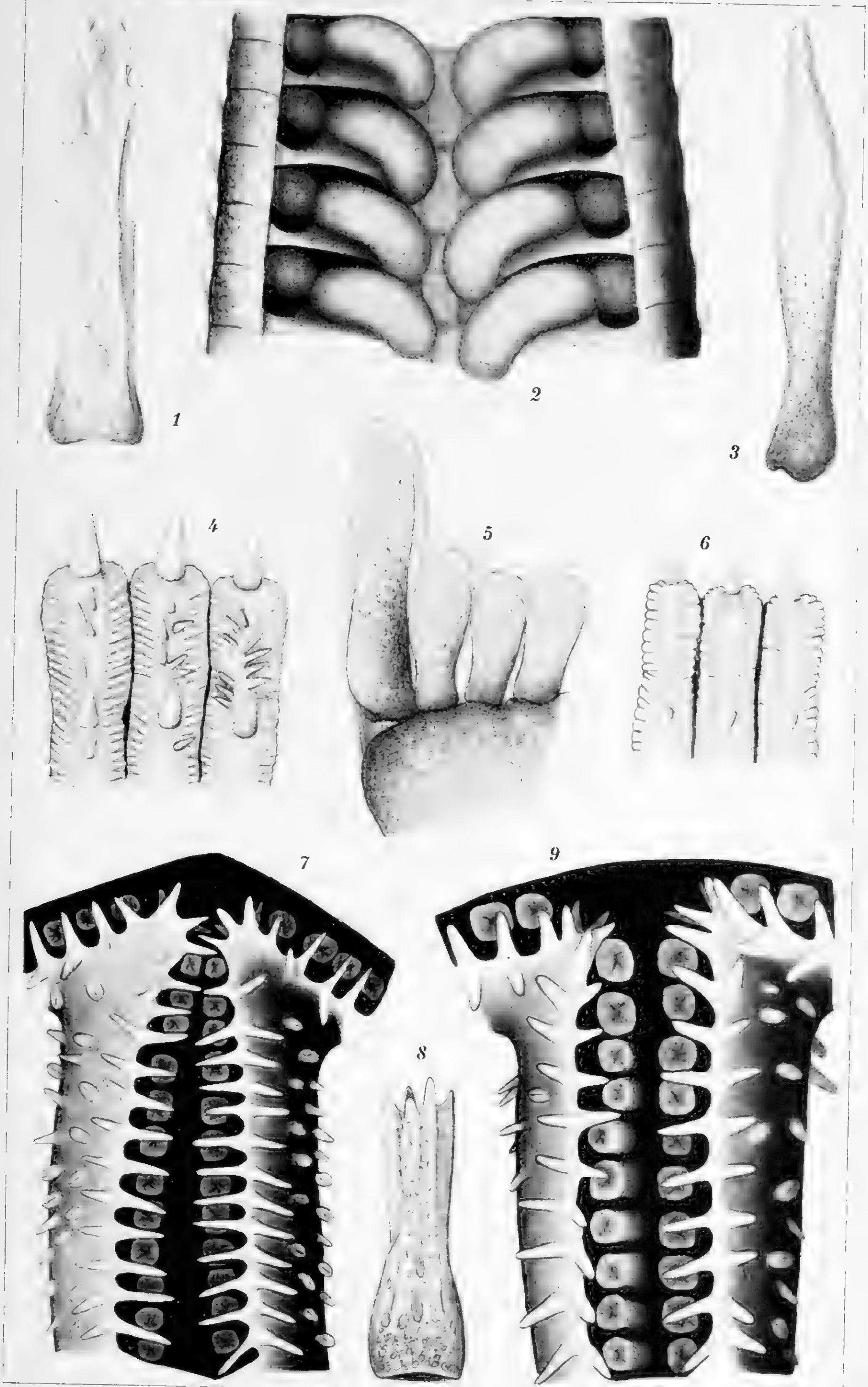
Plate XIV.

PLATE XIV.

Fig. 1. Adambulacral spine of *Pedicellaster palæocrystallus* Sladen. $^{115}/_1$.
— 2. Part of the interior of an arm of *Bathybiaster vexillifer* Wyv. Thomson, showing the very large ampullæ. $^{5}/_1$.
— 3. Mouth-spine (sphæridia) of *Pteraster pulvillus* M. Sars. $^{20}/_1$.
— 4. Marginal plates of *Ctenodiscus crispatus*, Var. (Comp. Fig. 6). $^{6}/_1$.
— 5. Adambulacral spines of *Bathybiaster vexillifer*. $^{22}/_1$.
— 6. Marginal plates of *Ctenodiscus crispatus*, typical form (Comp. Fig. 4). $^{6}/_1$.
— 7. Inner part of arm of *Pedicellaster typicus*. $^{12}/_1$.
— 8. Dorsal spine of *Stichaster albulus*. $^{85}/_1$.
— 9. Inner part of arm of *Pedicellaster palæocrystallus*. $^{17}/_1$.



Th. Mortensen del.

Pacht & Crone phototyp.

Plate XV.

PLATE XV.

Fig. 1. Valve of crossed pedicellaria, smaller form, of *Pedicellaster palæocrystallus.* $^{190}/_{1}$.

— 2. Crossed pedicellaria, small form, of *Pedicellaster typicus.* $^{115}/_{1}$.

— 3. Valve of crossed pedicellaria, small form, of *Pedicellaster typicus.* $^{190}/_{1}$.

— 4. Crossed pedicellaria, large form, of *Pedicellaster palæocrystallus.* $^{115}/_{1}$.

— 5. Valve of crossed pedicellaria, large form, of *Pedicellaster typicus.* $^{175}/_{1}$.

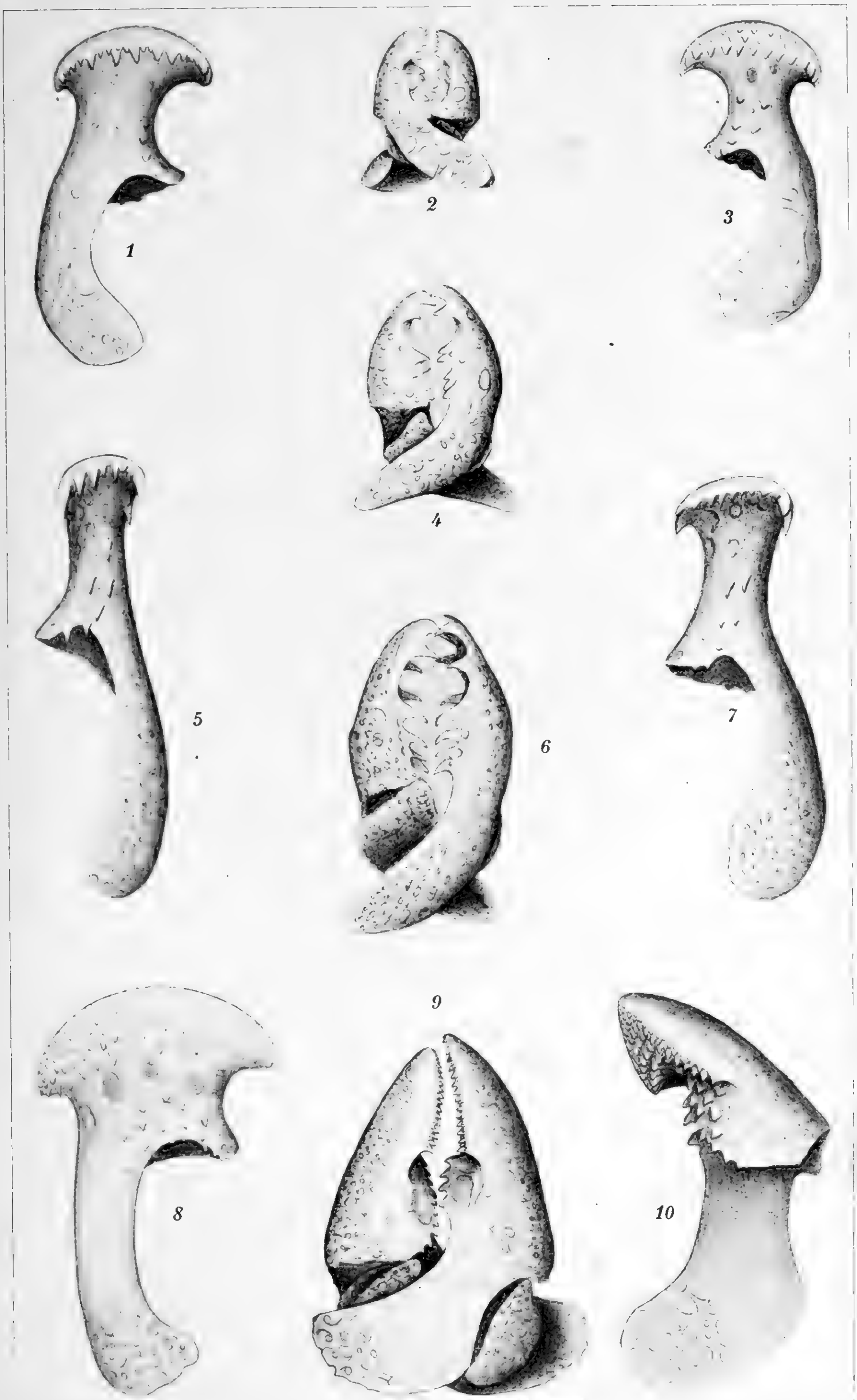
— 6. Crossed pedicellaria, large form, of *Pedicellaster typicus.* $^{115}/_{1}$.

— 7. Valve of crossed pedicellaria, large form, of *Pedicellaster palæocrystallus.* $^{190}/_{1}$.

— 8. Valve of crossed pedicellaria of *Stichaster albulus,* from the inside. $^{215}/_{1}$.

— 9. Crossed pedicellaria of *Stichaster albulus.* $^{200}/_{1}$.

— 10. Valve of crossed pedicellaria of *Stichaster albulus*, side view. $^{215}/_{1}$.



Th. Mortensen del. Pacht & Crone phototyp.

Plate XVI.

PLATE XVI.

Fig. 1. *Ophioglypha robusta* (Ayr.); part of oral side, showing abnormal development of papillæ between the inner pores. $^{10}/_{1}$.

— 2. Spine from the dorsal paxillæ of *Pteraster militaris* (O. F. Müll.). $^{45}/_{1}$.

— 3. Spine from the dorsal paxillæ of *Pteraster pulvillus* M. Sars. $^{45}/_{1}$.

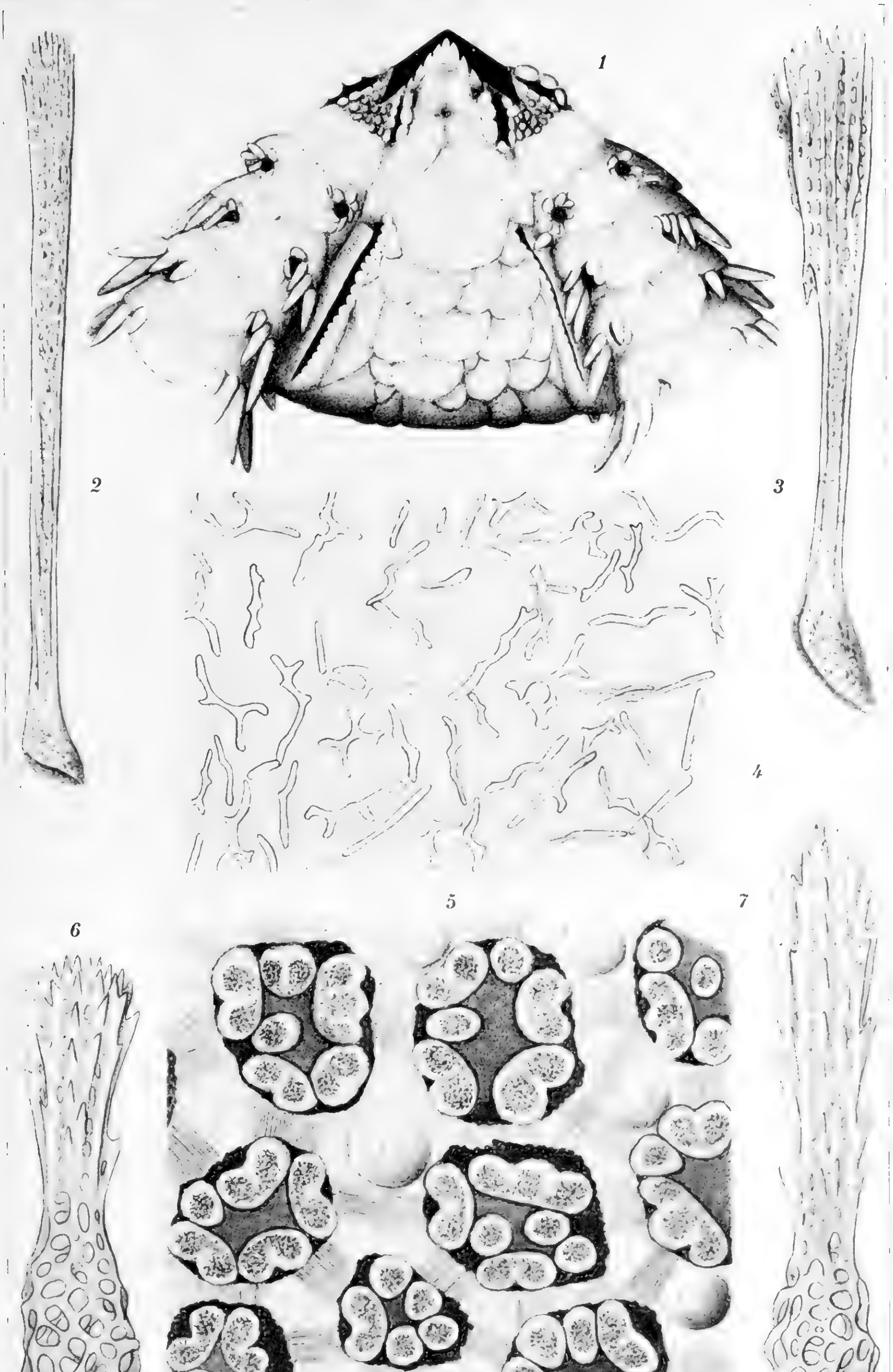
— 4. Part of the wall of the stomach of *Ctenodiscus crispatus*, showing the spicules in their natural position. $^{115}/_{1}$.

— 5. Part of dorsal skin of *Ctenodiscus crispatus*, showing radiating muscles between the paxillæ. $^{35}/_{1}$.

— 6. Spine of *Poraniomorpha tumida* (Stuxb.), from the dorsal side. $^{250}/_{1}$.

— 7. Spine of *Poraniomorpha tumida* (Stuxb.), from the oral side. $^{210}/_{1}$.

PL. XVI



Th. Mortensen del.

Pacht & Crone phototyp.

Plate XVII.

PLATE XVII.

Fig. 1. Calcareous plate from the dorsal skin of *Pteraster militaris;* side view (Comp. Fig. 11). $^{200}/_{1}$.

— 2. Part of section of decalcified adambulacral spine of *Asterias panopla* Stuxb., showing the numerous granular (mucous?) cells in the epidermis. $^{250}/_{1}$.

— 3 6. Calcareous plates of *Phyllophorus pellucidus,* Var. *Barthii.* Fig. 3. Side view. $^{300}/_{1}$.

— 7. Sucking disk of *Phyllophorus pellucidus,* Var. *Barthii.* $^{300}/_{1}$.

— 8. Section through an ampulla of *Bathybiaster vexillifer,* showing the great development of the muscles. $^{22}/_{1}$.

— 9. Sucking disk of young *Cucumaria frondosa* (Gunn.). $^{160}/_{1}$.

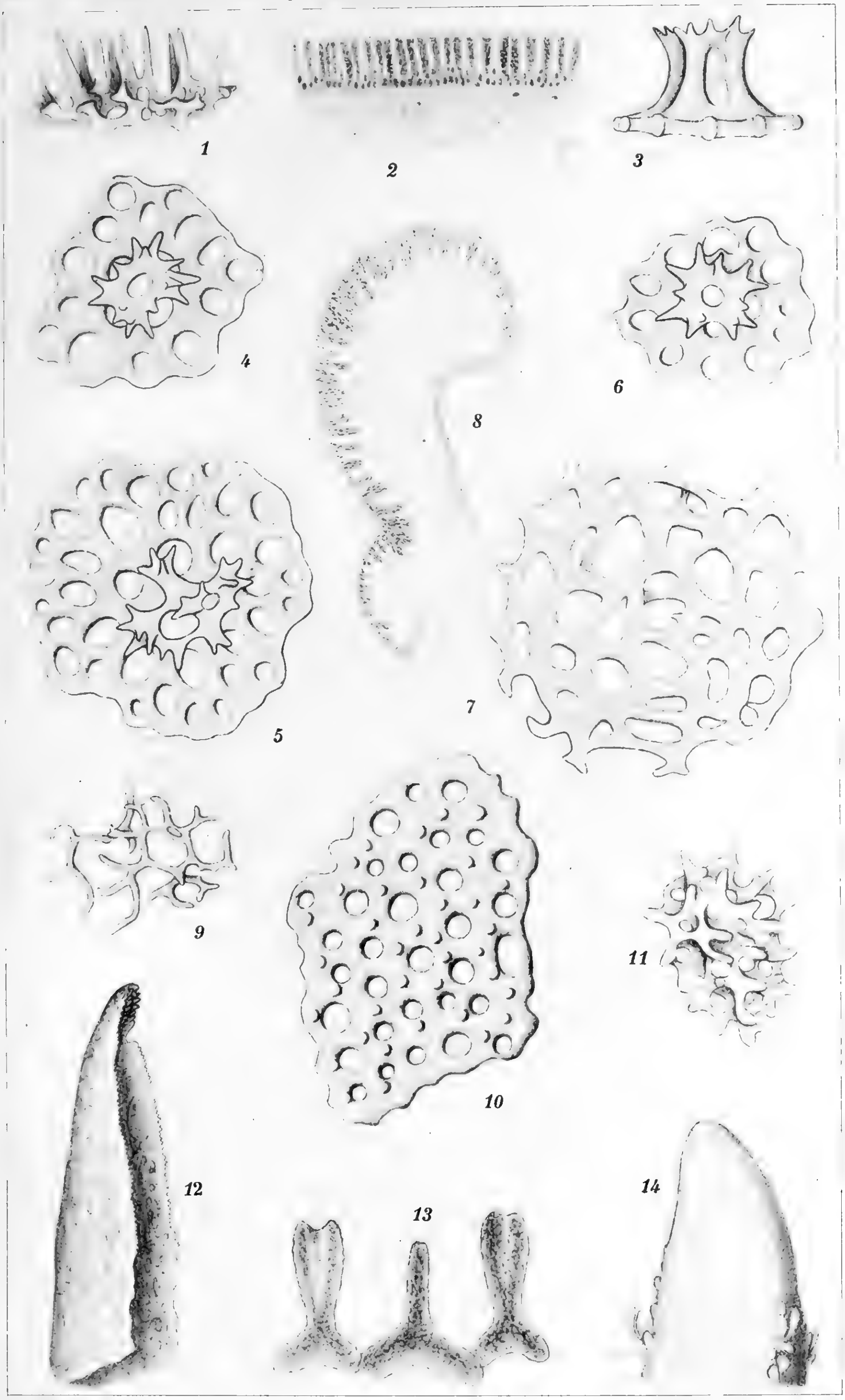
— 10. Calcareous plate of young *Cucumaria frondosa* (Gunn.). $^{160}/_{1}$.

— 11. Calcareous plate from the dorsal skin of *Pteraster militaris* (Comp. Fig. 1). $^{200}/_{1}$.

— 12. Valve of straight pedicellaria of *Stichaster albulus.* $^{200}/_{1}$.

— 13. Part of the calcareous ring of a young *Cucumaria frondosa,* 10 mm long. $^{38}/_{1}$.

— 14. Tubefoot of *Bathybiaster vexillifer.* $^{10}/_{1}$.



Th. Mortensen del. Pacht & Crone phototyp.

V.

DIE ENTOMOSTRAKEN DER DANMARK-EXPEDITION

VON

Dr. VINCENZ BREHM, EGER

1911

Die von der Danmark-Expedition nach Europa gebrachten Entomostraken erweitern nicht nur ganz im allgemeinen unsere Kenntnisse von der Fauna Grönlands, sondern gewinnen noch an Interesse dadurch, dass sie in einem bislang ganz unbekannten Gebiet gesammelt wurden und so den schon von Wesenberg-Lund gemachten Versuch der Gliederung Grönlands in verschiedene faunistische Bezirke fortsetzen lassen. Überdies bietet das Material, schon wegen der hohen Breitenlage, in der gesammelt wurde, auch für den Biologen mancherlei Interesse.

Die Proben, teils Plankton, teils Sumpfmoos enthaltend, sind in Alkohol konserviert und geben Zeugnis von einer ganz überraschenden Fülle tierischen Lebens. Wenn wir speciell den Entomostraken unser Augenmerk zuwenden, so kommen aus der bislang erschienenen Literatur fast nur zwei Arbeiten in Betracht: Wesenberg-Lunds Mitteilungen über die Phyllopoden und Vanhöffens zoologischer Bericht über die Drygalsky-Expedition. Ferner hat Ekman in einer vergleichenden Tabelle auf Grund der genannten beiden Arbeiten die niederen Kruster Grönlands denen der übrigen arktischen Gebiete gegenübergestellt und aus dieser Zusammenstellung den Schluss gezogen, dass Grönland gegenüber den anderen arktischen Subregionen sich durch das Vorkommen von *Latona glacialis* und *Diaptomus minutus* auszeichnet. Man wird wohl auch noch *Artemia gracilis* zu den charakteristischen Arten rechnen müssen, umsomehr, als diese Art die ja auch sonst zu Tage tretenden Beziehungen zu Nord-Amerika zeigt.

Von den in Ekmans Tabelle verzeichneten Formen habe ich in dem mir vorgelegten Material nur einen kleinen Teil wieder gefunden. Bei mehr vereinzelt oder sporadisch auftretenden Arten, zumal wenn sie der Litoralfauna angehören, mag dies rein zufällig sein. Bei anderen Arten halte ich das negative Ergebnis für kennzeichnend für das untersuchte Gebiet. So dürften dem nordöstlichen Grönland vollständig folgende Formen fehlen, die in anderen Teilen des Landes gefunden wurden:

Branchinecta paludosa, Holopedium gibberum, Bosmina obtusirostris, Eurycercus glacialis, Polyphemus pediculus, Acroperus harpae (?).

Andrerseits wurde eine Reihe von Tieren gefunden, die bisher aus Grönland nicht bekannt waren; zumeist sind dies Kopepoden und Ostrakoden; da nun gerade hinsichtlich dieser beiden Gruppen bisher fast nichts bekannt war, wäre es viel zu gewagt, diese für Grönland neuen Arten als Charakterformen Nordöstgrönlands in Anspruch nehmen zu wollen. Nachstehend gebe ich vorerst ein Verzeichnis der gefundenen Arten. Die für Grönland neuen sind mit einem Sternchen bezeichnet:

Phyllopoda.

Lepidurus arcticus Pallas.

Cladocera.

Daphnia pulex de Geer.
Macrothrix hirsuticornis Norm. & Nr.
**Lynceus rectangulus* G. O. Sars.
Chydorus sphaericus O. F. M.

Copepoda.

**Limnocalanus macrurus* G. O. Sars.
Diaptomus minutus Lillj.
Cyclops strenuus Fisch.
**Canthocamptus cuspidatus* Schmeil.
* — *duthiei* Scott.
**Epactophanes richardi* Mrazek.
**Maraenobiotus Danmarki nov. spec.*

Ostrakoda.

**Candona groenlandica nov. spec.*
**Herpetocypris glacialis* G. O. Sars.

Besprechung der einzelnen Arten:

Phyllopoda.

1. Lepidurus arcticus Pallas.

Pl. XVIII, Figs. 1—2.)

Sowohl ausgebildete Tiere wie die pelagisch lebenden Larven sind in mehreren Proben z. T. häufig vorhanden. Es ist dies beachtenswert, weil *Lepidurus arcticus* im westlichen Grönland nach Norden hin eine auffällige Abnahme zeigt. Während nach Wesenberg-Lund im südlichen Grönland dieser Phyllopode recht verbreitet ist, konnte Vanhöffen im Umanakgebiet ihn überhaupt nicht finden; nur Ryder meldet sein Vorkommen bei Kingartak unter 72°, N. B. Das stärkere Vordringen nach Norden hängt jedesfalls mit dem günstigeren Klima an der Ostküste zusammen. In einigen Proben fanden sich Entwicklungsstadien. Insbesondere enthielten die am 23. VI. 1908 und 26. VI. 1908 gemachten Aufsammlungen eine ziemliche Zahl von Larven, die etwa dem Stadium entsprachen, das Sars im ersten Band seiner Fauna Norvegiae 1896 p. 79 beschreibt und auf Pl. XI

fig. 4 abbildet. Ich habe keine jüngeren Stadien entdecken können und auch Sars sagt: The earlist stage observed is figured etc.

In einigen Kleinigkeiten weichen die von mir gesehenen Exemplare von der Beschreibung von Sars ab — Sars sagt z. B.: The body has a length (not including the caudal filaments) of only about 2 mm and is semi-transparent and of a yellowish red colour. — Die von der Danmark-Expedition gesammelten Tiere sind undurchsichtig und blaugrau. Speciell in der Bildung des Körperendes zeigen sich Abweichungen, die mir den Gedanken nahelegten, ob die mir vorliegenden Larvenstadien nicht am Ende doch dem von Sars beschriebenen zeitlich vorangehen. Dass ich dieser Frage nicht weiter nachgegangen bin und das vergleichend morphologische Studium dieser interessanten Larvenformen, das gewiss noch manche erwünschte Ergänzung der Darstellung von Sars möglich gemacht hätte, unterlassen habe, hat seinen Grund darin, dass ich glaubte, dieses wertvolle Material zu Gunsten einer anatomischen Untersuchung dieser Larvenstadien ganz erhalten zu sollen. Eine anatomische Untersuchung all dieser Entwicklungsstadien, die wertvolle Aufschlüsse verspricht, muss ich jedoch einer auf diesem Gebiete sachkundigeren Hand überlassen.

Wie die Kopie der Sarsischen Abbildung zeigt und aus seinen Worten hervorgeht, ist die Bewehrung des Körperendes anders bei den von ihm beobachteten Larven und den mir aus Grönland vorliegenden. Er sagt nämlich: „The caudal filaments are still quite short, scarcely more than $^1/_3$ of the length of the body, and exhibit a somewhat fusiform shape. They are set all round with fine, adpressed spines, which, however, are not arranged in distinct transverse rows; and at the extremity there is one particularly long spine and 2 short ones".

Die in Grönland gesammelten Larven haben am Ende der Caudalfilamente lediglich eine kleine und eine etwas grössere Klaue. Zahlreich sind in einzelnen Proben Tiere, die nahezu ausgewachsen sind und von den „full grown" Tieren sich abgesehen von der geringeren Grösse durch die Gestalt der *caudal lamina* unterscheiden. Dieselbe „is very small, acquires" „several (2—3) marginal spines" und trägt 2 grosse Zacken am Ende, wie bei den jüngeren Larvenstadien. Solche jüngere Tiere sind zumeist in den im Monate Juli z. T. auch noch im August gesammelten Proben enthalten. Die im späten August gefangenen Tiere erreichen enorme Grösse. Wie Sars angibt, bestehen die Kolonien zunächst nur aus Weibchen. Nur in einem vom 20. VIII. 06 stammenden Fange glaube ich auch Männchen gesehen zu haben.

Cladocera.

1. **Daphnia pulex** de Geer.

Sepiabraune bis $^1/_2$ cm grossen Tiere in den Proben vom See beim Hafen (Ende Juli 1907) und in einer Schmelzwasserlake beim Stormkap (13. VI. 07); fast immer kamen auch Ephippien zur Beobachtung. Auffälliger Weise fehlen in dem hier gesammelten Material Tiere, die der Wesenberg-Lund'schen *Daphnia groenlandica* entsprechen. Die in einer Probe, gesammelt am 1. IX. 1907 im See bei Hvalrosodden, enthaltenen Exemplare trugen durchwegs Ephippien.

2. **Macrothrix hirsuticornis** Norm et Brady.

Die Gattung *Macrothrix* ist nach den bisherigen Untersuchungen in Grönland durch die beiden Arten *M. rosea* und *hirsuticornis* vertreten. *M. rosea* gehört nur dem Süden an, während *M. hirsuticornis*, die durch ihr Vorkommen auf Spitzbergen und im nördlichsten Europa als hochnordisch gekennzeichnet ist, für Ostgrönland charakteristisch ist. Häufig in einer Pediastrumreichen Probe vom 30. VII. 07 bezeichnet mit „Sø paa Maroussia (Skibshavnen)".

3. **Lynceus rectangulus** G. O. Sars.

Zu dieser Sammelart zähle ich einen *Lynceus*, den ich nur in 2 Exemplaren antraf. Die 450 μ langen Tiere haben einen schmalen Schnabel, der beinahe das Niveau des unteren Schalenrandes erreicht. Das Mittelglied des Innenastes der Ruderantennen zeigt keinen Stachelkranz, wie er für die zu *Lynceus rectangulus* gehörige *Alona coronata* als Merkmal angegeben wird. Am Grundglied des Aussenastes, sowie an den beiden Endgliedern der II. Antenne sitzt je ein Stachel, so wie es Keilhack für *Alona weltneri* angibt, wie es aber wohl auch für die Mehrzahl der übrigen *Lynceus*-Arten gilt. Der Hinterkörper endet in einen abgerundeten spitzen Winkel und trägt 6 Zähne mit seitlichen Borstenbündeln. Die Endkrallen sind nicht gestrichelt und tragen einen mässigen Basaldorn. Bei dem einzigen vollständigen Exemplar deutete die verfärbte Rückenpartie der Schale auf Dauereibildung. Gefunden in einem See beim Schiffshafen, Ende Juli 1907.

Chydorus sphaericus O. F. M.

Häufig in den meisten Proben. Die untersuchten Exemplare waren durchwegs Weibchen. Die vom Grund der Litoralregion des dritten Sees beim Stormkap stammenden Exemplare, die am 11. VI. 1907 gesammelt wurden, als der See noch nicht eisfrei war, waren

häufig mit einer *Floscularia* bedeckt, die in ihrem kontrahierten Zustand nicht mehr bestimmt werden konnte.

Copepoda.

Epactophanes richardi Mrazek.

(Pl. XVIII, Fig. 3.)

Als Seltenheit in der am 24. VI. 07 beim Stormkap gesammelten Probe beobachtet. Diese sonderbare, schon als Nauplius blinde Art wurde von Mrazek bei Pribram in Böhmen entdeckt als Bewohner submersen Mooses. Dort lebt *Epactophanes* in Gesellschaft von *Darwinula stevensoni*. Meines Wissens ist *Epactophanes* seit seiner Entdeckung niemals mehr gesehen worden. Seine Wiederauffindung in Grönland zeigt uns, dass wir es mit einem arktischen Tiere zu tun haben dürften. Die genauere Erforschung der arktischen Harpakticidenfauna dürfte noch wiederholt zu Funden von *Epactophanes* führen.

Epactophanes wird mit 500 μ Körperlänge in Grönland nicht grösser als in der von Mrazek entdeckten versprengten mitteleuropäischen Kolonie. Auch im Bau einzelner Körperteile sind mir keine nennenswerten Abweichungen von den Mrazek'schen Abbildungen aufgefallen, wie solche wohl bei der weiten räumlichen Trennung der beiden Fundorte zu erwarten gewesen wären. Nur am vierten Fuss ist der äusserste der 3 terminalen Anhänge des dritten Aussenastgliedes mehr stachelartig entwickelt; die darüber am Aussenrand inserierte Borste ist bei den grönländischen Tieren vielleicht etwas höher inseriert. Der Bau des fünften Fusses und des *operculum anale* entspricht ganz den Mrazek'schen Abbildungen[1], die ich durch eine Dorsalansicht der Furka ergänze. Das Exemplar stammt aus einem kleinen Rinnsal beim Stormkap.

Maraenobiotus Mrazek.

Maraenobiotus zählt zu den häufigeren und charakteristischen Vertretern der Harpakticiden im hohen Norden. Leider sind die bisher bekannten beiden arktischen Arten *M. insignipes* und *brucei* unvollständig beschrieben, so dass eine absolut sichere Identifikation nicht gut möglich ist. Deshalb bezeichne ich die eine vorgefundene Art nur mit Vorbehalt als

Maraenobiotus brucei Rich?

In manchen Punkten erinnerten die Tiere an *M. vejdovskyi*; ja, wenn nicht das noch unbeschriebene Männchen genügende Anhaltspunkte

[1] Bzw. Beschreibungen.

bietet, ist es nicht unmöglich, dass die Trennung der beiden Arten keine scharfe ist. Die Bedornung der drei letzten Abdominalsegmente und ganz speciell die des letzten ist ausserordentlich stark, so dass man von ganzen Stachelkämmen reden kann. Die äussere Furkalborste ist kaum $^1/_3$ so lang als die innere. Den Nebenast der II. Antenne halte ich für eingliedrig. Der Innenast des I. Schwimmfusspaares ist merklich länger als der Aussenast. Am ersten Glied des 5. Fusses fehlt nicht nur konstant die äusserste der fünf Borsten, sondern häufig noch eine weitere, so dass nur mehr 3 Anhänge übrig sind. Die äusserste Borste am 2. Glied des fünften Fusses erschien mir immer ungefiedert (*vejdovskyi*-Charakter!). Solche Tiere fanden sich in einer Probe, die den Vermerk trug: „Annekssøen N. for Hvalrosodden, 87 m dyb, 22. V. 08, $2^1/_2$ met. Is".

Maraenobiotus Danmarki *nov. spec.*

(Pl. XVIII, Figs. 3—9, Pl. XIX, Figs. 10—13.)

Diese in der nächst dem Schiffshafen Ende Juli 1907 gesammelte Probe in beiden Geschlechtern angetroffene Art gehört unzweifelhaft in den Verwandtschaftskreis, dem *M. brucei* und *insignipes* angehören.

Weibchen. Das erste Fusspaar hat einen Innenast[1], der etwas länger als der Aussenast ist (fig. 4). Das zweite Fusspaar (fig. 5) hat einen kurzen Innenast, an dessen Endglied terminal ein Stachel (an der Aussenecke) und 2 Borsten (nach innen zu) stehen. Das Endglied trägt am Aussenrand einen Stachel, am Ende zwei Stacheln und eine Borste; der Innenrand dieses Glieder ist völlig unbewehrt. Das zweite Glied dieses Astes trägt am Innenrand eine kleine Borste. Das dritte Fusspaar zeigt am Ende des zweiten Gliedes des Innenastes am Aussenrand einen Stachel, daneben zwei Borsten. Das zweite Glied des Aussenastes ist am Innenrand unbewehrt (fig. 6) und das dritte Glied besitzt am Innenrand auch nur eine einzige Borste, während alle bisher bekannten *Maraenobiotus*-Arten dort zwei Anhänge, seien es nun Borsten oder Stacheln besitzen. Der vierte Fuss zeigt am zweiten und dritten Glied des Aussenastes je eine Innenrandborste, während der Innenast an seinem Innenrande 2 Borsten (so wie bei *brucei* und *insignipes*) aufweist. Das rudimentäre Füsschen besitzt an dem flachen Basalglied 6 Borsten, an dem zweiten Glied nur 3 Anhänge, von denen (fig. 7) der innere und äussere kurze Borsten sind; die innere derselben ist deutlich gefiedert, bei der äussern glaube ich Fiederung bemerkt zu haben; jedenfalls aber ist diese Befiederung kaum sichtbar.

[1] Das erste und zweite Glied des Innenastes des 1. Fusses bedornt.

Die Furkalglieder sind länger als das letzte Segment (wie bei *insignipes*) tragen jedoch hinter der Dorsalborste eine Dornenreihe (wie *brucei*). Die äussere[1] Furkalborste ist kaum so lang als die Hälfte der inneren. Das *operculum anale* ist mit wenigen, grossen Dornen ausgerüstet. Die Bedornung des Abdominalsegments ist kräftig, jedoch auf die Seiten beschränkt (fig. 8).

Die äusseren Geschlechtsteile sind in fig. 9 wiedergegeben. Diesbezüglich liegen von anderen Arten nicht hinreichende Beobachtungen zum Vergleiche vor.

Männchen. Das erste Fusspaar fig. 10 zeigt keine auffälligen Verhältnisse. Beim zweiten Fusspaar scheint das zweite Glied des Innenastes am Aussenrand unbedornt zu sein; am Innenrand trägt es ebenso wie das erste Glied eine Borste. Der dritte Fuss weist eine sehr eigentümliche Form auf (fig. 11). Die Innenborste des ersten Gliedes des Innenastes ist länger als das erste Glied. Am Ende des Innenastes befindet sich ein korkzieherartig gewundener Stachel. Eine solche Bildung ist bisher noch von keiner *Maraenobiotus*-Art bekannt. Allerdings ist leider das dritte Fusspaar des Männchens weder von *M. brucei* noch von *M. insignipes*, den beiden arktischen Spezies, die als Vergleichsobjekte in erster Linie in Betracht kämen, beschrieben worden. Es ist möglich, dass auch diesen beiden Arten diese Eigentümlichkeit zukommt und dadurch die Zusammengehörigkeit der genannten beiden arktischen Arten mit unserer neuen Spezies sichtbar würde. Das rudimentäre Füsschen (fig. 12) zeigt nur einen kurzen Fortsatz der Innenseite des ersten Gliedes, der mit zwei gefiederten Borsten bewehrt ist. Von diesen ist im Gegensatz zu *insignipes* die innere weit länger als die äussere. Das zweite Glied trägt vier Anhänge, also einen mehr als das Weibchen (und auch als *insignipes* nach Lilljeborg).

Die im zweiten Drittel der Dorsalseite der Abdominalsegmente befindlichen Stachelreihen sind in der Mitte nicht unterbrochen, doch sind die medialen Dornen viel kleiner als die seitenständigen. Wie ferner aus fig. 13 hervorgeht ist das *operculum anale* mit noch weniger Zähnen besetzt als beim Weibchen, nämlich mit vieren. Die Furkaläste sind terminal nicht in der Weise bedornt, wie beim Weibchen.

Die zweite Antenne trägt einen zweigliedrigen Nebenast. Der Aussenrand des dritten Gliedes dieser Antenne trägt nahe der Basis eine Gruppe kleiner Dornen und in der Mitte und nahe dem Ende je einen Stachel.

[1] Die innerste Furkalborste scheint äusserst reduziert oder völlig verschwunden zu sein.

Canthocamptus cuspidatus Schmeil.

(Pl. XIX, Fig. 14—17.)

Diese von Schmeil im Rhätikon entdeckte Art ist im Norden weit verbreitet von Schottland und den Shetlandinseln bis in die skandinavischen Hochgebirge. Dort beobachtete Ekman eine Reihe Abweichungen von den alpinen Tieren. Teilweise stimmen auch die grönländischen Exemplare mit der Beschreibung der Ekman'schen Tiere überein, in manchen Punkten weichen sie von beiden bisher beschriebenen Typen ab.

Mit Ekmans Beschreibung stimmen die grönländischen Tiere in folgendem überein: Am Innenrande des Aussenastes des zweiten Gliedes am ersten Beinpaare befindet sich ein Dorn. Die fünften Füsse tragen reichere und wechselnde Bedornung als die Rhätikontiere.

An der Furka fällt im Gegensatz zu den bisher beschriebenen Typen auf, dass die kurze Innenborste, der die Art den Namen *cuspidatus* verdankt, nicht die charakteristische, knieförmige Biegung zeigt und in manchen Fällen die doppelte Länge der Furka erreicht. (Überhaupt scheint *C. cuspidatus* eine weitgehende individuelle Variation zu zeigen.) Die Ventralansicht der Furka des Weibchens zeigt am terminalen Ende statt 2—3 Stacheln, wie es bei den Rhätikontieren der Fall ist, deren 5—6.

Eine weitere Eigentümlichkeit, die ich weder in den Beschreibungen und Abbildungen von Schmeil noch in denen von Ekman finde, die mir deshalb für die grönländische Kolonie charakteristisch zu sein scheint ist folgende: das zweite Glied des rudimentären Füsschens besitzt eine abnorm bewehrte Borste. Die innerste der starken Terminalborsten trägt statt der Befiederung einen starken, einseitigen Kamm von groben Zinken.

Der Nebenast der zweiten Antenne, der bisher noch nicht abgebildet wurde, trägt ausser den vier Anhängen, noch einen kurzen oft nur von 3 Borsten gebildeten Borstenkamm. Die Eiballen der Weibchen enthalten nur zwei Eier. Fand sich in Proben aus einem kleinen See beim Schiffshafen (23. VII. 07) und in einem andern dort befindlichen See Ende Juli 1907.

Canthocamptus duthiei Scott??

Da von diesem mit *C. duthiei* verwandten oder vielleicht identischen *Canthocamptus* nur ein ♂ zur Beobachtung gelangte, bin ich nicht in der Lage zu entscheiden, ob es sich um eine neue oder um eine bekannte Art handelt. Der zweigliederige Innenast des I. Fusses, der unbewehrte Analdeckel, die Kürze des Sinneskolbens am 4. Glied der I. Antenne und z. T. auch der Bau des rudimentären Füsschens würden

für *duthiei* sprechen. Fand sich in einem See bei „Hvalrosodden" etwa 40 engl. Meilen vom Hafen entfernt 31. VIII. 06.

Cyclops strenuus Fisch.

Diese als stenotherme Glacialform in Europa bekannte Form tritt, wie zu erwarten, in Grönland im Plankton sehr häufig auf, z. B. in einem See beim Schiffshafen (19. IX. 1907). Die Eiballen enthalten in Durchschnitt 10—12 Eier. Die Länge der ausgewachsenen Weibchen beträgt 2100 μ.

Diaptomus minutus Lilljeborg.

Nur in einer Probe kam dieser für Grönland recht charakteristische *Diaptomus* in zwei Exemplaren vor, die mit *Limnocalanus*-Spermatophoren behaftet waren. In einem grossen See „Sælsøen ved Hvalrosodden, 116 m dyb. Planktontræk (vertikalt) 0—50 m. 24. V. 1908". Die Eisdecke war 176 cm stark.

Limnocalanus macrurus G. O. Sars.

Diese aus Grönland bisher nicht bekannte Art tritt bekanntlich in Nordeuropa an Örtlichkeiten auf, die deutlich zeigen, dass ein glaciales marines Relikt vorliegt, das in keinem Wasserbecken vorkommt, das ausserhalb des Gebietes der grössten Ausdehnung des Yoldia-Meeres liegt. Es ist wohl anzunehmen, dass die grönländischen *Limnocalanus*-Kolonien ebenfalls von der arktisch-marinen Stammform, die mit *L. grimaldi* identisch oder nahe verwandt sein musste, abstammen und es erheben sich nunmehr drei Fragen: 1) Haben die Reliktkolonien Grönlands dieselben Umwandlungen in morphologischer Hinsicht erfahren wie die skandinavischen und 2) haben die von *Limnocalanus* bewohnten Gewässer Grönlands einen geologisch nachweisbaren Zusammenhang mit dem Eismeer besessen, sowie 3) fällt diese Kommunikation zeitlich mit der Yoldiaperiode zusammen oder nicht. Zur Beantwortung der 1. Frage verglich ich die mir vorliegenden grönländischen Tiere mit Exemplaren des *Limnocalanus macrurus*, die dem Ekoln in Schweden entstammten und mir von meinem Freunde Dr. Sven Ekman, Jönköping, zur Verfügung gestellt waren. Es zeigte sich völlige Übereinstimmung. Die Frage 2 und 3 muss einem Geologen überlassen bleiben. In „Sælsøen ved Hvalrosodden 116 m. Planktontræk (vertikalt) 0—50 m. 28. VI. 08".

Ostrakoden.

Candona groenlandica *nov. spec.*

(Pl. XIX, Figs. 18—19.)

Diese Art gehört zur *lapponica*-Gruppe, unter welchem Namen ich jene vier von Ekman beschriebenen Candonen (*lapponica, pyg-*

maea, laciniata und *longipes*) hier zusammenfasse, die morphologisch durch die gestreckte Form und die langen Borsten der Antennen des I. Paares, biologisch durch ihren arktischen Charakter ihre Zusammengehörigkeit bekunden. *Candona groenlandica* ist eine im Untersuchungsgebiet der Danmark-Expedition überaus häufige und verbreitete Art. Sie steht der *Candona laciniata* Ekman nahe, unterscheidet sich aber durch den anders geformten Genitalhöcker und den Besitz einer Genitalhöckerchitinleiste. Über diese Gebilde und einige andere morphologische Details geben die Abbildungen nähere Auskunft. In einem See beim Stormkap am 14. VI. 1907 am Grund des Litorals gefangen, ferner in einem anderen diesem nahe gelegenen See am 12. VI. 1907 und in grosser Zahl in einem See beim Schiffshafen (Ende Juli 1907).

Herpetocypris glacialis G. O. Sars.

Diese Art, die nach Sven Ekmans Untersuchungen in einigen Gewässern der Birken- und Grauweidenregion[1] ihre Südgrenze erreicht, war bisher aus Spitzbergen, von der Bäreninsel, Barentsinsel bei Nowaja Semlja bekannt.

Die Exemplare von der mit 20 bezeichneten Probe waren hellockergelb mit zwei schwarzgrün pigmentierten Bändern und unterschieden sich von der typischen Art wohl nur dadurch, dass die Furka nicht nur distal, sondern ihrer ganzen Länge nach Zähnchen trägt.

In der Probe 10 fand ich *H. glacialis* in grossen Exemplaren, die derartig durchsichtig und dabei am Rücken prächtig blaugrün gefärbt waren, dass man an *Stenocypris malcolmsoni* Brady erinnert wurde. Die Exemplaren wurden in Seen bei Hvalrosodden (Aug. 1906) und beim Schiffshafen (Juli 1907) erbeutet.

Zusammenfassung.

Die Durchmusterung der Proben ergab einen überraschenden Reichtum an Individuen und wohl auch an Arten. Doch ist das Verhältnis der Anteile verschiedener Gruppen an dieser hocharktischen Fauna ein wesentlich anderes als bei der mitteleuropäischen Fauna, indem die Ostrakoden und ganz besonders die Harpakticiden viel stärker in den Vordergrund treten. Gering ist die Beteiligung der Diaptomiden an der Zusammensetzung des Plankton. Das Plankton

[1] Lapplands und in Finnmarken.

zeigt ähnlich wie in alpinen Seen ein Überwiegen des Zooplankton gegenüber dem Phytoplankton. Vermutlich ist letzteres als Centrifugenplankton entwickelt. Übrigens fällt am Ufermaterial auch das Fehlen epiphytischer Überzüge auf Krustern auf. Vielfach erscheinen auch die Tümpelbewohner ganz hyalin und dabei prachtvoll gefärbt (cf. *Herpetocypris*). Mir scheint diese Beobachtung eine weitere Stütze für die von mir aufgestellte Hypothese zu sein, dass die Carotinfärbungen der Krustaceen Licht in Wärme umsetzen sollen. Die dauernde Belichtung im hohen Norden erschiene als besonders ertragreiche Wärmequelle und ist in Zusammenhang zu bringen mit der starken Farbenentwicklung als Transformationsapparat. Noch in einer zweiten Beziehung wäre den abweichenden Belichtungsverhältnissen des hohen Nordens Beachtung zu schenken. Es scheint mir auffällig, dass gerade dort die augenlosen Formen unter den Harpakticiden stark vertreten sind (cf. *Epactophanes* und *Maraenobiotus*).

Obwohl in dem mir vorliegenden Material gerade die beiden Charakterformen Grönlands, *Latona glacialis* nnd *Diaptomus minutus*, fehlen bzw. — letzterer — nur einmal zur Beobachtung kamen, woraus ich schliesse, dass die genannten Arten in Grönland nur strichweise auftreten, will ich doch auch auf die Frage der zoogeographischen Stellung und Herkunft der grönländischen Fauna zurückkommen. Zuletzt hat Vanhöffen diese früher schon von Wesenberg-Lund ventilierte Frage angeschnitten und im Gegensatz zu früheren Autoren die Ansicht geäussert, dass die heutige Fauna Grönlands die Nachkommenschaft der präglazialen Fauna darstelle, dass Grönland durch die Eiszeit keineswegs alles Lebens beraubt wurde. Hiezu möchte ich — indem ich mich Vanhöffens Ansicht anschliesse — bemerken: Wäre Grönland durch das Glazialphänomen seiner Organismen beraubt worden, so hätten diese schwerlich — wie ihre Schicksalsgenossen in Nordeuropa — einen Ausweg nach Süden übers Meer hinweg gefunden. Es hätte also nicht eine räumliche Verschiebung, sondern eine Vernichtung der präglazialen Tierwelt Grönlands eintreten müssen. Dann wäre die heutige Tierwelt Grönlands lediglich das Ergebnis der Einschleppungstätigkeit wandernder Vögel. Dem entspricht weder die Mannigfaltigkeit noch z. T. die Eigenart der hier heimischen Fauna. Dass während der Eiszeit aber keineswegs alle Lebensbedingungen unterbunden waren, wie der fern von Grönland am grünen Tisch arbeitende Zoologe meinen könnte, geht aus den Erfahrungen Vanhöffens und anderer in Grönland tätig gewesener Forscher hervor. V. sagt: „Wenn man nicht selbst Grönland bereist hat, ist es schwer zu glauben, dass der dunkle Fels im Sommer sich gelegentlich auf 40° C. erwärmt. Gibt man dem-

nach Nunataks zu, die sich selbst bei der grössten Ausdehnung des Inlandeises erhielten, so waren auch stets annehmbare Bedingungen für die genügsame Süsswasserfauna vorhanden".

Ganz besonders möchte ich aber darauf aufmerksam machen, dass viele der in Grönland heimischen nordischen Arten, dort kleine Abweichungen von den übrigen Kolonien zeigen (cf. *Herpetocypris*, *Canthocamptus cuspidatus*), die mir deutlich zu beweisen scheinen, dass eine postglaziale etwa noch andauernde Einschleppung dieser Arten nicht Geltung hat.

Sollten sich *Candona groenlandica* und *Maraenobiotus Danmarki* als spezifisch grönländische Tiere erweisen, so wäre dieser Schluss umso zwingender. Ob dabei an einen engeren Zusammenhang mit der amerikanischen oder europäischen Fauna zu denken ist, mag mit Rücksicht auf die mangelnden Kenntnisse über die Harpakticidenfauna Islands und Nordamerikas hier unerörtert bleiben. Feststehend scheint mir das Resultat: Die rezente Fauna Grönlands ist autochthon.

Elbogen, 29. XI. 09.

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TAFELERKLÄRUNG.

Taf. XVIII.

Lepidurus arcticus Pallas.

1. Schwanzabschnitt einer Larve. Kopie der Abbildung aus der Fauna Norvegiae von Sars.
2. Schwanzabschnitt der in Grönland erbeuteten Larven. (See beim Hvalrosodden 26. VI. 1908.)

Epactophanes richardi Mraz.

3. Furka, dorsal.

Maraenobiotus Danmarki nov. spec.

4. Erster Fuss des Weibchens.
5. Zweiter — - —
6. Dritter — - —
7. Fünfter — - —
8. Genitalfalten des Weibchens.
9. Abdomen und Furka, dorsal.

Taf. XIX.

Maraenobiotus Danmarki nov. spec.

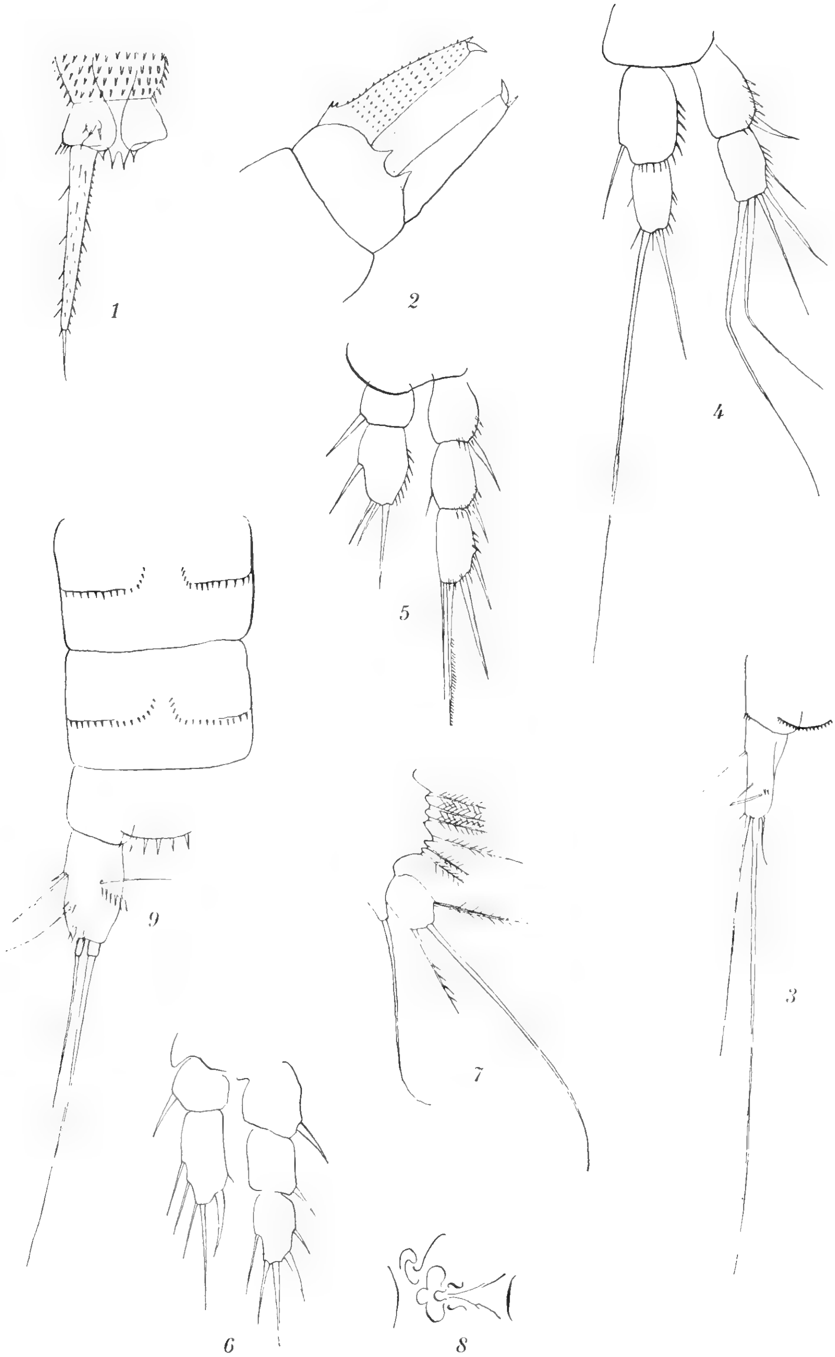
10. Erster Fuss des Männchens.
11. Dritter — - —
12. Fünfter — - —
13. Furka des Männchens, dorsal.

Canthocamptus cuspidatus Schmeil.

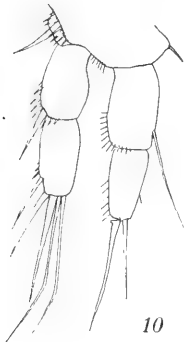
14. Fünfter Fuss des Weibchens.
15. Nebenast der zweiten Antenne.
16. Furka ventral.
17. Furka dorsal und Analdeckel.

Candona groenlandica nov. spec.

18. Umrissskizze.
19. Hinterleib mit Genitalhöcker und Chitinspangen.



V. Brehm del. TYP. BIANCO LUNO



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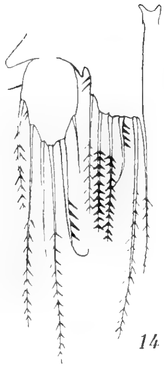

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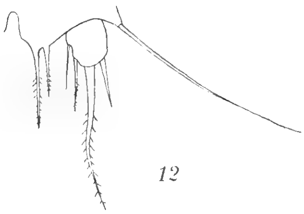

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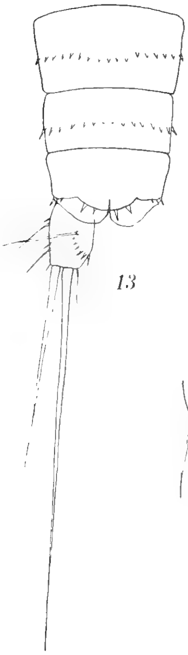

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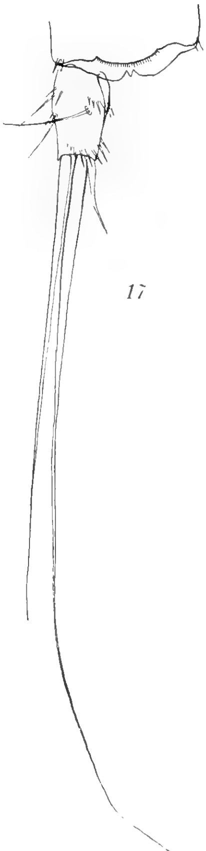

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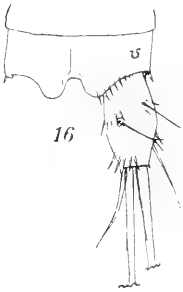

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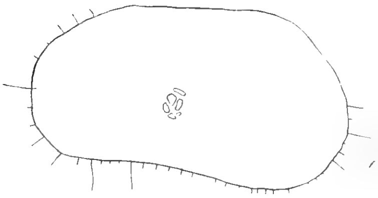

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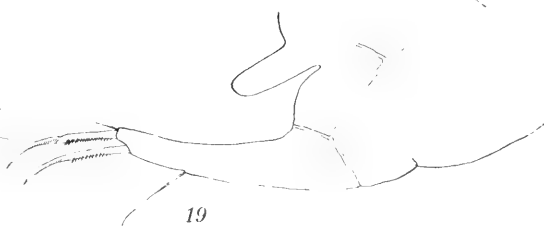

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TYP. BIANCO LUNO

VI.

FRESHWATER LIFE IN NORTH-EAST GREENLAND

BY

FRITS JOHANSEN

1911

The following, brief description makes no claim, naturally, to be an exhaustive account of the organic life in the freshwaters (rivers, lakes, pools and bogs) in the regions (ca. 77° N. L., ca. 20° W. L.), where the observations were chiefly made by the Danmark Expedition in 1906—1908. For this the special reports on the animal and plant forms discovered must first be available, and of these only a part have been published (OSTENFELD and LUNDAGER, "Vascular Plants"; BØRGESEN, "Fresh Water Algae"; HESSELBO, "Mosses"; JENSEN, "Hepaticae"; LIND, "Fungi"; ØSTRUP, "Diatoms" and BREHM, "Die Entomostraca", in this series of publications). Further, the promised, general review of the flora (written by LUNDAGER) has not yet appeared, and this would have been of great usefulness in the account of the conditions dealt with here. The reason why the present contribution to the freshwater life in North-East Greenland nevertheless appears at the present moment, is that some information may already be given concerning the natural conditions of the freshwater in general and concerning the biology of a few of the larger and more important animals in particular. These last have indeed been dealt with by Dr. V. BREHM in his paper above mentioned, and I have cursorily touched upon the conditions outlined here in my earlier paper[1]. What was said there regarding the nature of the land investigated (the temperature etc.) also applies naturally for the present paper, and in A. L. V. MANNICHE's paper ("Mammals and Birds") in this series a general description of the land will be found, which along with the accompanying, excellent chart of "Winge's Coast" (where a typical low-land locality with plenty of water is represented) is of great interest for the conditions discussed here. In these two papers a number of figures are also given (figs. 1, 3 and 4 in my own and figs. 2, 7, 9 and 10 in the part on the mammals and figs. 9, 10, 11 and 17 in that on the birds), which better than any words give an idea of the appearance of the North-East Greenland lakes in the landscape.

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[1] FRITS JOHANSEN: General Remarks on the Life of Insects and Arachnids in North-East Greenland.

There are two main kinds of freshwater in North-East Greenland, partly true lakes, formed from an earlier ice-covering or arms of the sea that have become fresh after a long period of time, under a milder climate and with the raising of the land; partly water from the melted snows of the winter in the form of larger or smaller water-courses, small lakes and bogs. In the case of the first-named, the lakes even at the end of the summer always contain some water (though its depth may be but small); whereas the collections of water from the melting snow (at least the rivers) are often quite dried up at this time. Naturally, it is possible to find a combination of the two kinds at many places; usually the lake has an inlet or outlet and is surrounded by pools or bogs. This however does not apply so much to the deeper lakes, which generally lie more or less up in the land; where these have arisen from the melting of an earlier ice-covering at the place (e. g. numerous lakes on "Koldewey Øer" and "Germania Land"), they usually lie in rocky country, are more or less circular in form and have steep sides the whole way round. If on the other hand the lakes have been old arms of the sea, which have become fresh after the raising of the land, they have as a rule preserved their fjord-form, and here and there along the margin and at one of the ends at least they have low, sand or clay banks. While these "ice lakes" owing to their situation and natural conditions have not been closely investigated by the Expedition, this has been the case with two of the "sea lakes"; and as the latter are of special interest in regard to their topography, hydrography and animal life, they are described in more detail here.

If we follow up the large river which falls into "Dove Bugt" near "Hvalrosodden", we come to an extensive lake which lies ca. 3 miles from the coast and extends some 25 miles from east to west to the inland ice like a gut ca. 1—2 miles broad, following almost the 77th parallel. Its name is "Sælsøen" (Seal Lake), as a seal (*Phoca foetida* L.) was supposed to have been seen in it. The country between the outlet of the river and the sea consists of extensive low plains of gravel, sand and clay; here and there an outstanding mass of rocks marks an earlier island. But as we gradually mount higher up the lake, the banks become higher (though at most places they are easily accessible, with a foreshore of gravel and stones, probably deposited by the glacial rivers which have run out into or through the lake). Here the water at the banks is shallow, increasing regularly in depth out into the lake; but still higher up the lake is

enclosed by steep cliffs, and there is deep water close in to these at most places. At the end the lake ends in a glacier which comes down from the inland ice behind. Small rivers fall into the lake here and there, but still more numerous and more extensive are the dried-up river beds, just as everywhere in North-East Greenland. About halfway along the north side of the lake there is a river

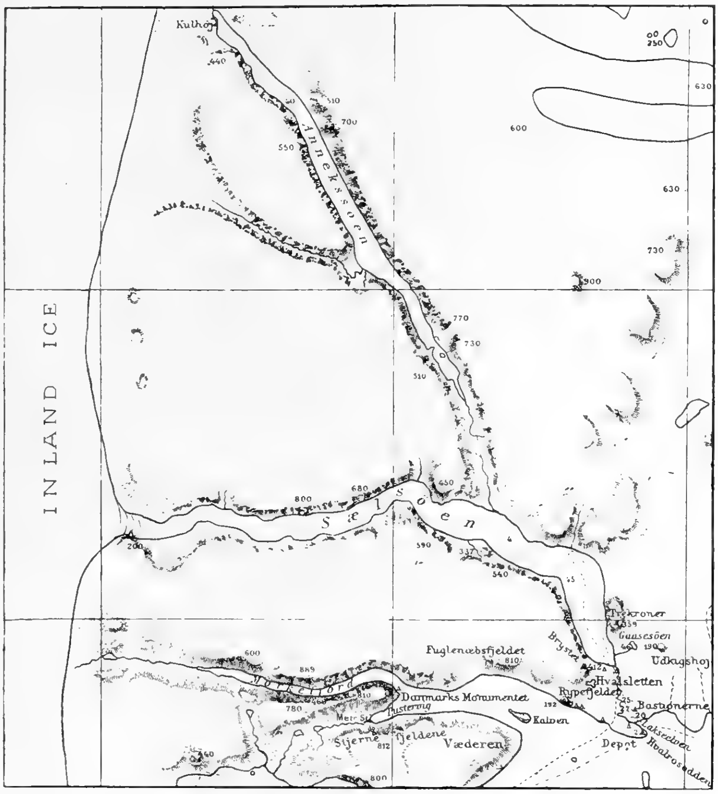


Fig. 1. Map of "Sælsöen" and "Annekssöen".

which now only fills a small part of its large bed; it comes from the more northerly lake "Annekssøen", which has a breadth of ca. 1 mile and cuts through the land ("Germania Land") in a S. E.—N. W. direction for a distance of ca. 20 miles and reaches almost into the inland ice to the north of Sælsöen. The most southerly bank of Annekssöen (at the outlet) is also formed of extensive clay plains and gravel ridges, while higher up it is enclosed by high hills with rough moraine ground in front in the form of slopes, which grade

evenly down to the level of the lake at most places, but at others there are steep cliffs with deep water close in. That Sælsøen owes its origin for the most part at any rate to the sea, is shown by the form of the surrounding country and by the fact, that even high up in the lake I have found by its banks pieces of drift-wood and fossil shells *(Mya truncata, Saxicava arctica).* But a more detailed description of the formation of the lake and its present appearance will probably be given in the geological account of the land.

Nothing definite is known as to whether Annekssøen is at any time free of ice, as the journeys made on it (April—June 1908) took place before the breaking up of the ice. The thickness of the ice measured on the lake (2—2½ meters), the large quantities of snow which lay on it (the direction of the lake is in line with the prevailing wind, which brings the heavy snow-storms in winter), its narrowness, the situation deep down between high hills, its open north end towards the inland ice — all this seems to indicate that the ice never breaks up, or at most only by the bank. My companion and I cut a hole in the ice at two places, where we imagined the lake might be deepest. The depth of water was the same (89 meters) and the bottom grayish brown clay. The hydrographical conditions are shown in the accompanying table:

21/5 08. 5—7 a. m.

Surface:	+ 0.3, + 0.0, + 0.12 C.	water fresh
2½ M.	+ 0.49 (just under the ice).	
10 -	+ 1.28	
20 -	+ 1.60	
30 -	+ 1.67	
40 -	+ 1.71	
50 -	+ 1.75	
60 -	+ 1.77	
70 -	+ 1.80	
80 -	+ 1.84	
85 -	+ 1.93	
87 -	+ 1.98	

In contrast to Sælsøen (see later), the bottom-water was not salt, as we had expected. I took 4 vertical hauls with a small plankton net (ca. ½ meter in diameter) with the following result:

1. 0—50 M.; contents were ca. half a score of pale-white copepods, 2 mm. long (*Maraenobiotus brucei,* Rich.).

2.	25-50 M.	No animal life. The copepods were thus found in 0—25 M.
3.	50-70 -	
4.	70-85 -	

On the other hand, Sælsøen may become quite free of ice as we found in August 1906 (icebergs from the inland ice were even floating about). But only a small part of it (the lower, eastern end) was ice-free in the unfavourable summer of 1907; on the rest of the lake lay the unbroken ice of the previous year (only melted along the bank). In the summer of 1908 we departed before the ice had completely melted (middle of July), but it was evident from the nature of the ice (very "porous"; much ice melted at the eastern end and along the banks), that at least most of the lake would become free of ice. On $^{11}/_{5}$ 08 the thickness of the ice was measured at one place (over 2 meters thick) and on $^{24}/_{5}$ 08 at another place (1.76 meters thick). At the end of June there is open water along the bank (just as in the smaller lakes to be mentioned later), but out in the centre the ice is still meter-thick and quite free of snow owing to the strong wind blowing down over it. The depth at the eastern end of the lake was but small (cf. the nature of the banks here as already mentioned), but increases gradually as we go further west; in the centre of the lake here the depth is 69 meters (bottom fine gray clay). The depth still increases towards the west; about halfway along the lake we found 117 meters (bottom as before). The hydrographical conditions in the lake are very interesting (cf. the two following tables), as the water at a depth of 55—56 meters changes over from fresh to brackish and further to strongly saline, and at the same time the temperature rises; in other words, the surface water and the bottom water are different. Regarding the nature of the currents between these two layers and in the Lake as a whole, as also whether the temperatures obtained hold good for other seasons of the year, nothing is known. On the same occasion, $^{23}/_{5}$ 08, I took three vertical hauls with the above-mentioned plankton net. (Depth and bottom as $^{24}/_{5}$ 1908.)

1.	115—85 M.	No animal life.
2.	85—55 -	
3.	55— 0 -	Here two pale-white copepods (*Diaptomus minutus* Lilljb.) one of them with egg-sac. *P. S.* At the same spot and depth I caught, a month later ($^{28}/_{6}$ 1908), some other, pale-white copepods (*Limnocalanus macrurus*, G. O. Sars).

11/5 1908. 9 a. m.—2 p. m. Depth 69 M. Thickness of ice over 2 M. Bottom grayish brown clay.

Surface:	+ 0.22° C.		water fresh
2½ M.	+ 0.07° (just below ice)		water fresh
20 -	+ 0.11°		water fresh
40 -	+ 0.29°		water fresh
50 -	+ 0.61°	Salinity 0.15	water fresh
54 -	+ 0.86°	— 0.12	water fresh
55 -	+ 0.91°		water fresh
56 -	+ 1.11°	— 5.0	water brackish
57.5 -	+ 1.32°	— 12.0	water salt (sulphuretted hydrogen).
60 -	+ 1.53°	— 13.0	water salt (sulphuretted hydrogen).
68 -	+ 1.70°	— 15.0	water salt (sulphuretted hydrogen).

24/5 1908. 7—12 p. m. Depth 117 M. Bottom as above. Thickness of ice 1,76 M.

Temperatures in Centigrade.

Surface:	+ 0.0°		water fresh
2 M.	+ 0.0°		water fresh
10 -	+ 0.17°		water fresh
20 -	+ 0.26°		water fresh
40 -	+ 0.43°		water fresh
50 -	+ 0.67°		water fresh
54 -	+ 0.93°		water fresh
55 -	+ 1.0°		water brackish
56 -	+ 1.18°		water salt
57 -	+ 1.29°		water salt
60 -	+ 1.53°		water salt
70 -	+ 1.72°		water salt
80 -	+ 1.93°	(slightly H_2S)	water salt
90 -	+ 2.12°	(a little -)	water salt
100 -	+ 2.19°	(distinctly -)	water salt
110 -	+ 2.32°	(less marked -)	water salt
115¾ -	+ 2.36°	(strongly -)	water salt

N. B. It will be seen from these two tables, that the cold, fresh surface water increases in warmth and salinity downwards. At 55—56 M. the bottom water begins to be noticed and contains more H_2S the further we descend.

P. S. The taking of the three, different species of copepods from Sælsöen and Annekssöen is very interesting, as they are (probably all three) glacial marine relicts.

We now turn to the smaller lakes (by comparison with Sælsøen and Annekssøen), which are scattered over the true coastal

land, on the often fertile, low stretches, which at many places lie between the inland hills and the sea. Owing to their situation it will readily be understood, that the extent of these lakes is dependent on the season of the year, the amount of the winter's snow, presence of outlet and inlet or not, and on their size and depth. In winter these water-basins are often never suspected, covered as they are by meter-thick ice and with snow, which makes them level with the surrounding land (the thickness of the ice measured reached about 2 meters). When the snowfall of the winter is not specially great and the early part of summer is warm (i. e. many sunny days), the snow may have melted along the banks of the lakes and ice-free water found here already at the end of May, even though owing to the frost at nights the water is covered by thin ice for most of the day (Hvalrosodden, May 1907); on the other hand, if there is much snow in winter and a good deal of fog in early summer, the banks of the lakes are not free of ice before the middle of June (Skibshavnen, 1908). But when the melting has once begun seriously, it can be watched spreading daily, until after 8—10 days most of the lakes are free of ice, all the more rapidly if the lake is small. For a couple of months the lakes are now open, until the night frost at the end of August becomes severe enough to form thin ice by the banks; gradually the ice spreads over the whole lake and from the middle of September the ice is so thick, that even the outlets cease to flow. The icy covering of the lakes in winter corresponds in thickness to the average temperature [in 1906—07 the winter was more severe than in 1907—08 and the thickness of the ice was thus different (ca. $2^1/_2$ and ca. 2 meters)]; the size and depth of the lake and the, in consequence, stronger or weaker currents in the water have certainly some importance also. Thus, all the lakes and pools which are shallower than ca. 2 meters are frozen to the bottom in winter — a condition which, taken in conjunction with the absence of openings and channels in the ice, makes it the more remarkable, that various animal forms are able to live, though the air has no access to the water, and even to become frozen-in in the mud *(Entomostraca)*.

In the littoral region, that is near the banks of the lake, the hydrographical conditions are naturally extremely variable. Here the power of the sun is greatest (owing to the surrounding, dark land and the shallow depth, so that the bottom gets warmed up); but it is also here that the autumn frost first forms the thin ice, which often thaws in the day-time (at the beginning). The time of day at which the temperature of the water is taken is also of great importance, as also the temperature of the air and the weather.

The highest temperature (about + 20°) occurs in sheltered small bays with rich vegetation and thick muddy bottom; a very different temperature (ca. + 2°) may be measured at places, where a mass of snow lies melting or under the thin ice.

Regarding the appearance of the lakes, reference should be made, as already mentioned, to the figures and chart of "Winges Coast", from which it will be seen, that they are often very shallow far out, as the stones of the bank and bottom reach above the water at many places or the vegetation is continued out under the water. The bank is sometimes stony and bare, sometimes sandy and flat with a slight vegetation of grass and sedge; or it has the form of a bog with copious vegetation where the lake is connected with larger or smaller pools; often a mass of snow lies on the bank, which on melting brings more water to the lake and causes this to overflow its banks and cover the surrounding land (month of June); or the lake replaces the water which evaporates or flows away from the shallow, outer margins as the summer nears its end (in August).

The banks may have a rich vegetation (chiefly *Salix, Ranunculus,* grasses, sedges etc.) in the form of small bluffs with offlying, lower, sandy places which pass evenly over to the bottom of the lake (sandy or muddy); or the vegetation may be very poor (mostly mosses and lichens) on the stony places, where the stone-covered land shelves out into the water. The light-brown mud (plant remains), which covers the bottom with a thicker or thinner layer, is interspersed in the shallow water with mosses, grasses and sedges (*Carex, Eriophorum* etc.) and *Hippuris,* and numerous green algae float about in the water especially at sheltered places. Along with the often teeming animal life here, the whole gives the bottom of the lake a richness and beauty the dry land mostly lacks. — Out in the deeper water (ca. 3 meters) the vegetation becomes scarcer and consists mostly of mosses and algae in the fine, brown mud; and still further out the mud becomes less rich in plant life and grayer in colour (see under Sælsøen and Annekssøen).

We may now select one of the lakes (of ca. 3 meters depth) for further description of the macroscopic life in it throughout the year.

If we go out in a boat on a summer's day to where the lake is deepest, or in autumn cut a hole down through the ice, and make some vertical hauls with the plankton net (bottom—surface), we obtain almost exclusively numbers of water-fleas (*Cyclops strenuus* Fisch.)

of both sexes (the females with egg-sacs in September). In colour they are transparent-reddish brown (the colour is collected into small, round bodies inside the carapace), which is an excellent protection for them. I have lain for a long time gazing down into the water, and it was only after the powers of observation had become considerably sharpened, that I was able to distinguish the animals from the surroundings (mud, stones etc.) and that only when they moved themselves with the characteristic hop. Taking up some of the bottom material in a dredge, we find in it the large red larvae of midges (*Chironomus* sp.) in the mud tubes in which they pass the winter. Whether *Cyclops* hibernates, I do not know; in the autumn we find it in different sizes ($^{19}/_{9}$ 07), in the spring I have not found it at all before the beginning of July (1907 and 08) and they are then all quite small (young).

In the shallower waters (0—1 meter) we meet with a much richer animal life, especially by the banks with vegetation. *Cyclops* is also common here as also the *Chironomus* larvae, but in addition we find numerous other midge larvae (*Culex, Tanypus* etc.), which crawl or twist about actively in the water. We can see the red worms (*Tubifex*?) in millions in their mud tubes, swinging here and there in the slight current or withdrawing themselves suddenly and then shortly afterwards protruding again. The pale fly larvae are also seen here and there — all a rich booty for the red mites, which are wandering about seeking their prey in amongst the leaves of vegetation at the bottom, like the men of the primeval forests. Chasing them, they hide under stones, among the moss and the like, which conceal their colour (the round body brick-red, the legs (with slightly developed swimming hairs) and the eyes purple-red). That these water-mites (*Lebertia fabricii*, Kr.) are just as much bottom animals as free-swimming, is shown apart from the legs also by the fact, that when I put them in a glass with water they sank fairly quickly down to the bottom, even whilst endeavouring to delay their progress by turning round with their legs in the water, without being able however to get up again; when they reached the bottom, they at once throw themselves upon the midge larvae present, taking fast hold at one place or another on the body of the prey in spite of the unfortunate animal's frantic efforts to get free. This struggle was seen most distinctly in the case of the large, red *Chironomus* larvae; the red colour of the latter first disappeared at the place where the Arachnid had fixed itself, and then gradually faded also from the rest of the animal, whose movements became weaker and weaker, until at last only a flabby, whitish worm remained and the Arachnid left it to seek for new booty. These Arachnids probably

hibernate but how long they take to grow, I do not know; throughout the summer (June—August) I have seen the adults, all of which had about the same size (the size of a pin's head) right from the melting of the lakes. Quite small, red larvae of this mite were found at the end of June 1908 sitting on *Chironomus*-pupa and -imago in the water (Hvalrosodden)[1].

If we take up a little of the green thread-algae, which are so common in the small, sheltered bays by the banks, we find in them a teeming animal life, consisting chiefly of Infusorians, Planarians, etc., and small, brown points drive about in a lively manner; these are the Cladocera, *Chydorus sphaericus* O. F. Müll., which perches on the algae; much commoner, however (especially free-swimming in the water a little further out) is another Cladocera species, namely,

Daphnia pulex de Geer.

This characteristic animal occurs in almost dried-up pools and owing to its more pelagic mode of life it is not so much bound to the banks (though this does not apply to the newly hatched young), but is rather met with in so deep water (up to ca. 1 meter), that there is room for it to swim. Like black grains of pepper dusted out into the water, they are seen "standing" in the water with extended antennae; from time to time they make sudden and powerful beats, then stop and beat again and so on; it is only when they are seeking food among the plants or make from the bottom to the surface or the reverse that they make many beats in succession, until they reach their goal. Where the water is flowing rapidly we do not find them, probably because, in contrast to *Apus* and the *Ostracoda*, they are more independent of the water-currents, and thus keep to quieter waters (bays and small pools etc.); here they are often seen in swarms in the still water. If they are swimming about in the water or if the bottom is dark (stony) I have many times experienced, how difficult it is to catch a sight of these transparent, dark-brown animals. They are typically littoral forms which live on the microscopic life by the banks of the lake; often we can see them busily feeding on the moss-plants and the like. That they can nevertheless be content with surprisingly little nourishment, I have often proved by keeping them in a glass with water; they were just as lively and numerous 3 days after as on the day they were taken.

[1] As mentioned in the "General Remarks", the same is the case with the earth-mites (*Trombidium*), as the larvae appear in the middle of June, the adults from May to August inclusive (and probably also the rest of the year).

Among the numerous, dark-brown animals in July and August we find individuals which are transparent and light-brown but of the same size; possibly they are some which have just cast their shells. The characteristic, black winter-eggs contain usually 2 eggs in the capsule; seen from the side (surface) they are almost crescent-shaped, whilst from the edge they resemble more a leguminous capsule with 2 seeds. They are exceedingly common in clumps of as many as 10 on blades of herbage and the like or they lie at the bottom of the water by the banks, especially under stones, in holes etc. It is not all the Daphnids, however, which deposit their winter-eggs, as we see partly from the fact, that the dead body of the mother with the egg is often found lying on the bottom, as also partly from this, that from the beginning of September, when the thin ice begins to form, the Daphnids are observed swimming about under the ice bearing their winter-eggs,and they become frozen into the ice when it becomes sufficiently thick; this leads to the death of the mother-animal without hurting in any way the winter-egg. The deposited winter-eggs have a greater specific gravity than the water; if we stir the latter the eggs are shaken up but soon sink again to the bottom. In the middle of June, however, we may see a few winter-eggs drifting about at the surface in a vertical position, and as the summer gradually advances we now see more and more of these; under a lens we find that the two eggs in each capsule are now distinctly separated from one another and surrounded by a whitish ring, probably because they are full of air. Placing these winter-eggs in a glass with water and letting them hatch out, I have found that they first lie on the bottom; then as development proceeds they gradually rise up in the water and at last the quite small young Daphnids issue from the eggs — earlier or later according as the ice by the banks melts quickly or slowly[1]. Yet throughout the whole summer (and the whole year for that part) we may meet with unhatched winter-eggs, some of which perhaps never develop or use more than one summer for that purpose. The newly hatched young are a little variable in size (up to ca. $^1/_5{}^{th}$ of the adults) and have the same form as the older; but they are more transparent and the colour is thus reddish yellow to greenish brown, a great advantage for them, as it is almost impossible to see them in the shallow and quiet water where they live among the herbage. They swim about actively here and find their food among the algae and herbage. In the course of the summer these young increase so much in size that (by keeping them in a glass with water) one can actually observe a daily growth, until in the middle of July

[1] Middle of June 1907, beginning of July 1908.

they have reached the size of the adult. It is thus only the winter-eggs which hibernate, whilst the animals themselves die in September; from the eggs the young ones hatch out in early summer and these grow in the course of the summer.

Ostracoda.

These animals are also met with in the littoral region especially by the banks of lakes where there is plenty of vegetation, and they are extremely common in bogs and pools. As a rule they are collected in groups at the bottom of the lake, where they creep about in the fine mud with slow movements; in general because there is some kind of food or other there, e. g. a dead *Apus glacialis*. I have myself seen (Hvalrosodden, August 1906), how they collect about such an animal and creep in under the carapace; taking this up we can see, how the Ostracods eat away its ventral half (on one *Apus* I found about 10 Ostracods). And even living *Apus* are not safe from them; it is however only at the end of the summer, when a number of the adult *Apus* are dying (and therefore weak) that we find them infested with the Ostracods. These appear therefore as a kind of carrion-feeder on the bottom. It is characteristic that, like *Apus* but in contrast to *Daphnia pulex*, they are found both in still and running water; as bottom-animals they are also better able to keep their place in the water in spite of the currents round about. They are fairly indifferent towards being dried up; thus on $^{24}/_{7}$ 1907 I have found living Ostracods in a quite dried-up pool at Skibshavnen; they had buried themselves down into the sligthly damp mud and thus sought to escape the dangers of evaporation their resting places are exposed to in the course of the summer. In August I have observed two forms of Ostracods, on the one hand numerous, larger (a pin's head in size) and greenish black animals and others which were fewer in number, only half as large and reddish brown.

When the thin ice begins to form in September, the Ostracods become more rare and less active; a portion have probably buried themselves down in the mud, but most of them are dead, and on the banks at many places we find numerous empty shells (collected in groups like the living animals), and these are also found again when the banks of the lake thaw in the early summer. If we closely examine the banks (Skibshavnen $^{17}/_{9}$ 07), we find the dead Ostracods on the mud-covered stalks of herbage (e. g. of moss) frozen into the ice; inside the open shells we then find a number of light-red grains, the hibernating eggs. When the ice melts along the banks of the

lake and the sun comes to warm up the water, the eggs develop — the more rapidly, the more sunny days there are (thus earlier in the clear summer of 1907, but later in the foggy, early summer of 1908). As an average for the period of development of the egg, from the time when it is found in the open water until the young appear, I believe that a week is sufficient, as I found the newly hatched young on $^{12}/_{6}$ 07 (Stormkap). They sat in quantities on the mud-covered moss and herbage near the banks or crawled about here by means of the hooks on their feet; or they come down into the mud, between the fine particles of which they are able to bury themselves quickly and neatly. They were never at rest, but moved about constantly here and there, seeking after food, which is plentiful there where they live. When I put them into a glass they sank quickly down to the bottom, though they endeavoured to slacken their downward descent by constantly whirling round and round with their legs. Their size was such that they could just be detected with the naked eye, and for this their colour was of assistance as this was conspicuous against the brownish yellow mud. The carapace and the feet projecting from these were pale yellow and inside, the body appeared as a small, reddish yellow spot. On keeping these young ones in a glass with water I observed, how they gradually increased in size; at the beginning of July (1907) or a little later (under unfavourable conditions, so that the young appeared later (1908)), we meet with the first, full-grown individuals. The conditions are thus quite the same as for *Daphnia pulex*; that it is the eggs which hibernate, whilst the adults die in the autumn; in early summer the eggs hatch out the young ones and these then increase in growth in the course of the summer.

Common to *Daphnia* and the Ostracods, further, is their wide distribution; not only are they met with in every little pool however small, but they are also common on islands out to sea (Maroussia, July 1907), whereas I have never found *Apus* there.

Apus glacialis Kr.

This large and characteristic *Entomostracon* is extremely common by the banks of all the lakes, mossy hollows etc. in North-East Greenland. It is mostly seen moving over muddy bottom with herbage; it ploughs its way down into the mud with the front part of its head, returns and again repeats the performance, or it buries itself down in the bottom with hasty, wriggling movements of the

tail; only the eyes remain free and the animal is thus concealed. The progression of the *Apus* along the bottom is marked by a characteristic, twisted tracing, which is formed by the feet whirling the fine sand and mud away from the middle line of the belly, so that a furrow is drawn across the bottom. The colour of the animal is an excellent means of protection against enemies; it is grayish, brown-yellow with small, dark points and spots, and in the water it assumes a greenish shade quite like, for example, the moss plants. Many a time I have lain by the banks and stared down into the water, which was full of *Apus*, but it was only when they moved that I observed them. They are found right in on such shallow water, that the carapace reaches the surface when they stand on their heads in searching the mud. Sometimes we see them suddenly mounting up through the water by means of active movements of the tail and feet and swim for a long time, hanging on the surface of the water with the ventral side uppermost and the tail downwards; the purpose of this is probably to provide themselves with the food-stuff there (*Infusoria* etc.) or to imbibe air. It is curious to notice how unwilling they are to lie on their backs; if they come into this position by sliding down a stone or by the water suddenly disturbing them, they set to work most strenuously with the tail and continuous waving of the feet, so that there is scarcely a single spot of the animal which is at rest — until they come right side up again. Their food, which they mainly seek in the mud at the bottom, consists of smaller animals; but that they may also take free-swimming forms I found in July 1907 by keeping a number of *Daphnia pulex* and *Apus* together in a glass with water; they captured the *Cladocera* by movements of the body and feet, but it was only when they had worked their prey up to the mouth that they got a firm hold of it and ate it up. Their greediness was very great and at last there was not a single *Daphnia* left, and as there was no more food in the glass the *Apus* gradually died; which seems to show that when they are free they must constantly have a supply of food to be able to exist. That they may also be satisfied with dead animals I observed on $^{12}/_{8}$ 1907, when I saw the *Apus* tearing up their dead comrades which lay on the bottom, so that only the carapace remained. Regarding the possibilities of life for them out of the water, I once observed numbers of small *Apus* by a bank, consisting of a flat, gravelly beach, which had been washed up and indicated the highwater mark like a margin; they were all very active and those highest up had already partly buried themselves down into the moist mud. If the part of the lake where the *Apus* live becomes dried up, one might believe the animals away, but on

taking up some of the mud they are found buried in it. That they can hibernate in the mud, as will be mentioned later, further witnesses to their tenacity of life.

In the middle of August we find that the females (even the smaller) have eggs in the brood-pouch, as these shine through the green chitinous shell as white points.[1] When the night-frost comes towards the end of the month, many of the adult *Apus* die (see under *Ostracoda*); we then find them lying dead or dying on the bottom of the lake; sometimes also they become frozen into the thin ice and thus perish. Yet many living *Apus* are still met with, buried down in the mud or swimming about in the water. The thin ice which forms definitely in the beginning of September, does not trouble them very much to begin with; if they do not get frozen into the bottom, we see them swimming up right to the under surface of the ice and "walking" along this; or they remain some time on the stalks of the herbage and the like; on these there are often small bubbles of air and one can see the animals literally imbibing these, as they are appreciably reduced or quite removed after the animal has changed its position. As the ice gradually becomes thicker and reaches the bottom, more and more *Apus* are frozen into this and perish, unless they have buried themselves down in the mud or migrated out into deeper water; if we take up the dead animals, we find some among them which contain pale-red eggs, the size of a pin's head, in their brood-pouch. These can also be seen singly, deposited on the moss-plants and the like, and the fact that they are enclosed in the ice does not seem to destroy them. —

When the ice on the banks thaws in the early summer (end of May 1907 and beginning of June 1908), we find the dead *Apus* lying by the banks, especially under stones; some of them contain the above-mentioned eggs in the brood-pouch, and these eggs are also found deposited on the water-plants. On keeping these eggs in a glass I have observed, how they gradually assume a deeper, reddish yellow colour, and little by little (after ca. one week) a small *Apus* young, very like the adult, is formed inside. On the embryo it is possible gradually to distinguish the frontal eye, carapace, body and tail, and a week later after the ice of the lake had begun to melt (middle of June 1907, end of June 1908), the characteristic fry of the year are found, which as a kind of *Metanauplius* (the free-swimming *Nauplius* is thus wanting in *Apus glacialis*) differs considerably in size, form and colour from the adults. It is almost as

[1] These are immature eggs; I have also found the females with the ripe eggs at this time.

large as the head of a pin, in colour sometimes whitish yellow — pale-red, sometimes orange yellow — purple red (the body, especially the spaces between the legs, is coloured most) and with blue-black frontal eye. The large lateral eyes are still wanting, and the tail spines are quite short, as also the carapace. On the other hand, the swimming palps (the second pair of antennæ) are very long in comparison with the whole animal and play an important part in movement, like the feet which are already present. It is difficult to catch sight of these young, as they mostly keep among the herbage on the bottom by the banks, under stones and the like; the newly hatched young are to begin with not very lively, but often only move themselves when they are stirred up. Further, by comparison with the young of *Daphnia* and the Ostracods they are very few in number and are found almost exclusively in sheltered corners, where there are collections of the green thread-algae and the small animals living among these — so that it was just a chance with specially good fortune that I was able on the whole to find them. Their mode of progression is extremely characteristic and pleasant to watch, as I have found on keeping them in a glass with water; they are very delicate, however, and much less tenacious of life than the *Daphnia* and *Ostracod*-young. If they are lying on the bottom, searching through this as the adults do, they may suddenly be seen rising with long strokes until they reach the surface. Under this they hang as a rule vertically with the tail bent a little in towards the underside of the body, and they swim almost entirely by means of the long palpi. With the latter they all the time make uniform and equal strokes of definite duration; and each time they advance they slip a little backwards. The movement reminds one to a great extent of that of a watch-spring; so long as it is going the movement proceeds regularly. Owing to the great amount of flexibility of the body and tail, these small animals can easily make all sorts of twistings and turnings, as somersaults etc., as they may suddenly instead of the regular, vertical hops throw themselves horizontally through the water; or they may roll themselves up and head first seek down to the bottom, shutting up the palpi under the carapace and moving by means of the foliaceous legs.

In the middle of July the metanauplii are no longer met with; but we now find somewhat larger, though small fry, which with exception of the short tail spines quite resemble the adults (also in colour), and they also occur at the same places. Sometimes we only notice them after taking some of the full-grown up out of the water (the latter, namely, are already common from the end of June, coming probably up out of the mud or in towards the banks

from the bottom of the deeper water where they have hibernated); a small individual can then be seen swimming away from under the large, where it has probably sought protection; of any care of the fry there can scarcely be any talk at this stage. The first, larger *Apus* met with by the banks, when the ice melts here in early summer, are young individuals (end of June); only later (middle of July) do we find the full-grown animals; in both cases, however, these are animals which have hibernated, instead of dying off like many of their fellows in the autumn, and their numbers on their reappearance in the spring contribute essentially to the occurrence of the species year by year. So far as I could see, the eggs and metanauplii are far too few in numbers (compare also the already mentioned delicateness and slight tenacity of life of the latter), to be able alone to account for the abundance of the species from year to year.

29. 6. 1911

VII.

REPORT ON THE HYDROIDS

COLLECTED BY THE DANMARK EXPEDITION AT NORTH-EAST GREENLAND

BY

P. KRAMP.

1911

INTRODUCTION
with remarks on the classification etc.

The following paper deals with the hydroids obtained by the Danmark Expedition to North-East Greenland in 1906—1908. Whilst the ship was stationed at Danmarks Havn, 76° 46′ N. L., 18° 14′ W. L., the zoologist of the Expedition, Mr. Fritz Johansen, made several excursions into the surrounding fjords and sounds and collected among other things a large material of hydroids. When the Expedition left for the home-voyage in the summer of 1908, a number of stations in deep water were investigated; at only three of these were hydroids found, namely, at the trawl stations 96, 99 and 104 b.

I have now worked through this large material; it contains 33 species, 3 of which are new.

I have not ventured to discuss the zoogeographical interest of the material, though it is certainly considerable, as there is still a large material of hydroids from the east coast of Greenland, which is not yet worked up. I have restricted myself to drawing up table 7, which displays the principal points in this connection of the zoogeographical conditions of the species mentioned. In the text I give a brief review of the geographical distribution of each species, referring at the same time to the papers of Jäderholm and Broch of 1909, (35) and (17). Jäderholm publishes precise information regarding the places where the species were found; Broch has drawn up some very practical lists showing the zoogeographical conditions for the arctic species.

With regard to the classification, I follow in the main the lead given by Levinsen, 1892 (38), which for the northern species has been carried further especially by Broch. In classifying we should naturally always pay attention to as many characters as possible; but in seeking to clear up the classification of the hydroids we often come into a difficult position, especially when the trophosomes are in very close agreement in species which show different

features in their reproduction. In such cases Levinsen and Broch seem to me right in laying chief weight on the structure of the nutritive individuals. Though it must seem of great importance, whether a species produces free medusae or sessile gonophores, it is yet impossible to use this feature for the separation of the larger groups, as we thus separate species, which are obviously nearly related and belong together naturally (cf. the Fam. *Campanularidae*). On the other hand, to exclude the reproductive features entirely, is not an ideal procedure for a systematist who desires to find a natural system, and to justify doing so we must also have more detailed evidence from comparative anatomical investigations on the medusae or gonophores of nearly related forms. For the present, however, it seems to me both necessary and defensible, to keep the characteristics of reproduction in the background. We need not go so far as Schneider (51), who deprives the sexual individuals of any importance for the systematist, chiefly because "- - - die Geschlechtsproducte entstehen nicht in der Meduse, sondern im Trophosom; die Meduse ist nichts weiter als ein Apparat, der sie auf eine grosse Fläche vertheilt" (l. c. p. 491). But every "apparatus" must be regarded by the light of descent and the natural relationship, and cannot therefore be altogether deprived of systematic importance. It must be admitted nevertheless that the nutritive individuals are of the first importance. — A systematist cannot however be consistent. The same characters have not the same importance everywhere; an excellent example of this is given by the families *Lafoëidae* and *Campanulinidae*. Levinsen characterizes the last-named family as having an operculum in contrast to the first; as we shall see later, this distinction cannot be maintained. It is scarcely possible to set any definite limits between these two families based only on the trophosomes. And yet there is something which marks off the *Lafoëidae* as a naturally connected group, and this is the characteristic aggregates of gonothecae and transformed hydrothecae, which were earlier regarded as independent hydroid colonies (*Coppinia* and *Scapus*), and were first rightly interpreted by Levinsen, 1892 (38). Here we see that the gonosome helps to fix the boundaries between two related groups. Whether we should call such groups families or subfamilies is and will always be a matter of opinion. — The presence or absence of an operculum must therefore in this case be kept in the background as a systematic factor; but this by no means lessens the systematic importance which Levinsen ascribes to the operculum in the *Sertularidae*.

Broch rightly emphasizes the importance of investigations on the variations of the species, but when he says, "an den anderen

Tiergruppen kann man für solche Untersuchungen leichter Zählungen oder Masse verwenden, für die Hydroiden aber muss man die viel mehr zeitraubenden Projektionsmethoden meistens benutzen", (1909 (17), p. 135), I do not think he is right. We might be able to make measurements in such a manner, that we could obtain numerical expression for the special characteristics of the species, and if the material is sufficiently large such measurements would be an important help to the limitation of the species.

The projection method leaves too much freedom for a conscious or unconscious arbitrariness in the choice of the variants to be drawn, and can never give very trustworthy pictures, either of the extremes or of the norm for the species; the last would be of importance especially in biological regards in that it shows, how the species is typically developed in this or that locality under this or that set of natural conditions. A comparison of material from different places can only lead to a trustworthy result, when we have numbers to rely upon. An ingenious investigator may perhaps be able to draw far-reaching conclusions by simply glancing at a series of drawings; but his conclusions cannot be controlled by the less ingenious, who may desire more solid grounds for accepting the result as trustworthy. I hope in time to have the opportunity of going further into this matter and of using the numerical method in practice. In the present paper I have made a small endeavour in this direction but unfortunately the material is not very large.

To Inspector G. M. R. Levinsen, who entrusted this work to me and has helped me with advice and instruction, I would offer here my most sincere and hearty thanks.

Short characterization of the stations

comp. Table I.

St. *21.* 6—10 m. (meters). Soft bottom with *Laminaria.* Some colonies of *Lafoëa fruticosa* and a large (8 cm.) colony of *Eudendrium rameum,* compose the principal contents of the material from this station.

St. *36.* 10—15 m. Hard and soft bottom with *Laminaria* and *Delesseria.* A piece of *Laminaria* densely overgrown with *Campanularia integra.*

St. *63.* 20—40 m. Hard bottom with shells and red algae. A very rich station characterized especially by *Lafoëa fruticosa* and *Eudendrium rameum,* both of which occur in well-grown colonies with gonosomes. *Halecium muricatum* is also abundant. Of creeping species the most numerous are: *Campanularia integra, Calycella syringa, Cuspidella procumbens* and *Lafoëa serpens,* the two first-mentioned most frequently on *Delesseria,* the two last most frequently on the colonies of hydroids.

St. *64a.* Ca. 100 m. Rocky bottom. A colony of *Cellepora incrassata* Lamarck, overgrown inter alia with *Lafoëa serpens,* whose hydrothecae are here extremely long and narrow.

St. *66.* 30—40 m. Stones and shells with *Delesseria.* The leaves of *Delesseria* are overgrown with masses of *Camp. integra* and *Calycella syringa* and a few specimens of *Coryne eximia.*

St. *68a.* 40—60 m. Stones and shells with hydroids and a few red algae. A very rich station, containing a number of large colonies of *Halecium muricatum,* very often overgrown with *Cuspidella procumbens* and *Lafoëa serpens.* Strange to say, *Calycella syringa* is not found at this station, as I cannot be sure about a small, broken-off piece (3 hydrothecae), which may have been put in by mistake. *Campanularia integra* and *Eudendrium rameum* are rare.

St. *69.* 20—30 m. Stones and shells with *Delesseria.* The leaves of *Delesseria* are overgrown with a great many *Calycella syringa,* frequently also with *Camp. integra* and *Cuspidella procumbens.*

General list of the Stations, where Hydroids have been collected.

Number of Station	Date	Locality	Depth (meters)	Bottom	Apparatus
21	20—9—06	Danmarks Havn	6—10	Soft bottom with *Laminaria*	Dredge
36	13–10– „	do.	10—15	Hard and soft bottom with *Laminaria* and *Delesseria*	do.
63	21—8—07	Stormbugt	20—40	Hard bottom, stones with shells and red algae	do.
64 a	22—8— „	do. near Cape Helgoland	ca. 100	Rock with „corals“	do.
66	28—8— „	Stormbugt	30—40	Stones and shells with *Delesseria*	Alga Dredge
68 a	2—9— „	Off Cape Bismarck	40—60	Stones and shells with Hydroids and a few red algae	Dredge
69	2—9— „	Stormbugt	20—30	Stones and shells with *Delesseria*	do.
71 a	4—9— „	Off Cape Bismarck	30—40	Stones and shells with Hydroids and a few red algae	do.
72 b	10—9— „	Danmarks Havn	10—20	Rock with shells and a few red algae	Alga Dredge
72 c	9—9— „	Stormbugt	15—20	Mud with red algae	Dredge
94	19—7—08	The sound at Cape Bismarck	20—40	Hard bottom with *Laminaria* and *Delesseria*	Alga Dredge
95 a	19—7— „	The sound between Renskær and Maroussia	ca. 50–100	Hard bottom with Hydroids and a few red algae	do.
X	20—7— „	Along Cape Bismarck peninsula	?	Unknown	?
96	22—7— „	Off Maroussia	160—180	Hard bottom with Hydroids	Trawl
99	22—7— „	77° N. L. 17½° W. L.	300	Mud with some gravel	do.
104 b	28—7— „	76° 06' N. L. 13° 26' W. L.	200—250	Clay and gravel	do.

TABLE 1.

Number of Station	21	36	63	64 a	66	68 a	69	71 a	72 b	72 c	94	95 a	x	96	99	104 b	Summary
Date	20—9—06	13—10—06	21—8—07	22—8—07	28—8—07	2—9—07	2—9—07	4—9—07	10—9—07	9—9—07	19—7—08	19—7—08	20—7—08	22—7—08	22—7—08	28—7—08	
Vegetation	Laminaria	Lamin. and red algae	Red algae	0	Red algae	Red algae	Red algae	Red algae	Red algae	Red algae	Lamin. and red algae	Red algae	?	0	0	0	
Bottom (soft, hard)	s	h & s	h	h	h	h	h	h	h	s	h	h	?	h	s	s	
Depth in meters	6—10	10—15	20—40	ca. 100	30—40	40—60	20—30	30—40	10—20	15—20	20—40	ca. 50—100	?	160—180	300	200—250	
Rhizogeton nudum	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	1
Coryne eximia	.	.	rr	.	rr	rr	rr	r	.	.	.	.	.	.	.	.	5
Perigonimus sp.	.	.	rr	.	.	.	.	rr	.	.	rr	.	.	.	.	.	3
Garveia groenlandica	.	.	r	.	.	.	.	rr	.	.	rr	.	.	.	.	.	3
Eudendrium rameum	+	.	cc	.	.	r	r	rr	.	.	+	cc	+	r	.	.	9
„ tenellum	.	.	r	.	.	+	.	r	.	r	rr	.	.	.	.	.	5
Halecium muricatum	r	.	c	.	.	ccc	r	+	.	.	.	+	.	.	.	.	6

TABLE 2.

	bottom with veget.				hard bottom without veget.	soft „ „ „
	6—20 m. St. 21, 36, 72 b, 72 c	20—40 m. „ 63, 66, 69, 71 a, 94	40—60 m. „ 68 a	60—ca. 100 m. „ 95 a	ca. 100—200 m. „ 64 a, 96	> 200 m „ 99, 104 b
Rhizogeton nudum	.	r				
Coryne eximia	.	r	rr			
Perigonimus sp.	.	r				
Garveia groenlandica	.	r				
Eudendrium rameum	+	cc	r	cc	r	
„ tenellum	r	r	+			
Halecium muricatum	r	c	ccc	+		

„ labrosum	.	.	.	.	.	+	.	r	.	.	.	.	.	.	.	.	2	.	r	+			
„ curvicaule	r	.	r	.	.	rr	.	.	.	.	.	rr	.	+	.	.	5	r	r	rr	rr	+	
„ groenlandicum	.	.	.	.	.	.	.	.	.	.	.	rr	.	.	.	.	1	.	.	.	rr		
„ textum	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	.	.	.	.	+	
„ sp. (tenellum aff.)	.	.	rr	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	rr				
„ sp. (minutum aff.)	.	.	.	.	.	.	.	.	.	.	.	.	.	rr	.	.	1	.	.	.	.	rr	
Lafoëa fruticosa	+	.	cc	r	.	+	+	+	.	+	+	+	.	+	rr	r	12	+	cc	+	+	+	r
„ gracillima	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	.	+				
„ grandis	.	.	.	.	.	.	.	r	.	.	.	.	.	c	.	.	2	.	r	.	.	c	
„ serpens	r	.	c	r	.	cc	.	cc	.	r	.	.	.	rr	.	.	7	r	cc	cc	.	r	
Toichopoma obliquum	.	.	+	.	.	c	r	c	.	.	.	.	.	.	.	.	4	.	c	c			
Grammaria abietina	.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	.	2	.	+	.	.	+	
„ immersa	.	.	.	.	.	r	.	r	.	.	.	.	.	.	.	.	2	.	r	r			
Stegopoma fastigiatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	rr	.	1	.	.	.	.	.	rr
Cuspidella procumbens	r	.	c	.	.	cc	c	c	.	+	.	.	.	.	rr	.	7	+	cc	cc	.	.	rr
Calycella syringa	rr	.	c	.	cc	.	cc	cc	.	c	.	rr	r	.	rr	.	9	c	ccc	.	rr	.	rr
Tetrapoma quadridentatum	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	1	.	r	.			
Lafoëina maxima	.	.	.	.	.	.	.	r	.	.	.	+	+	.	.	.	3	.	r	.	+		
Sertularella tricuspidata	.	.	.	.	.	.	.	ccc	.	.	.	r	.	.	.	.	2	.	ccc	.	r		
„ gigantea	.	.	.	.	.	.	.	.	.	.	.	r	.	+	.	.	2	.	.	.	r	+	
Thujaria laxa	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	.	.	.	.	+	
Campanularia integra	r	+	c	.	cc	r	c	cc	+	+	.	c	cc	rr	.	.	12	c	ccc	r	c	rr	
„ volubilis	.	.	.	r	.	.	.	+	.	.	.	r	.	.	.	.	3	.	+	.	r	r	
„ groenlandica	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	1	.	.	.	.	r	
„ sp.	.	.	.	.	.	r	rr	r	.	.	.	.	.	.	.	.	3	.	r	r			
„ verticillata	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	1	.	+				
33 species Summary	8	1	14	3	3	13	9	24	1	6	5	11	4	12	4	1		9	26	13	11	13	4
																		28				16	

St. *71a.* 30—40 m. Stones and shells with hydroids and a few red algae. This very rich station is above all characterized by *Sertularella tricuspidata*, which is found in great abundance (it only occurs at one other station (95a) and there it is rare). The colonies are much overgrown with *Lafoëa serpens*; *Cuspidella procumbens* also occurs rather frequently. Quantities of *Campanularia integra* and *Calycella syringa* are attached to the rather numerous leaves of *Delesseria*. *Toichopoma obliquum* has its maximum appearance at this station. Less numerous are several other species, of which the following are not found at other stations: *Rhizogeton nudum, Tetrapoma quadridentatum, Lafoëa gracillima, Campanularia verticillata.* Some colonies of *Halecium muricatum* and *Lafoëa fruticosa* occur. *Eudendrium rameum* is very rare. Altogether 24 species.

St. *72b.* 10—20 m. Rocks with shells and a few red algae. A piece of *Laminaria* with *Campanularia integra*.

St. *72c.* 15—20 m. Mud with red algae. All the hydroids occurring are found on *Delesseria*, a few also on Balani.

St. *94.* 20—40 m. Hard bottom with *Laminaria* and *Delesseria*. Some few colonies of *Eudendrium rameum* and *Lafoëa fruticosa* compose the main contents of the material from this station.

St. *95a.* Ca. 50—100 m. Hard bottom with hydroids and a few red algae. There are several, large, vigorous colonies of *Eudendrium rameum* with plenty of gonophores. The leaves of *Delesseria* are densely overgrown with *Campanularia integra*; *Calycella syringa* on the other hand is rare. A very large colony and a few smaller ones of *Halecium muricatum*; 3 rather large colonies of *Lafoëina maxima*.

St. *X.* Depth unknown. The material received from the Botanical Museum, collected by the botanist of the Expedition, Mr. A. Lundager. The station has no number, but according to the date must be placed here. For the sake of brevity I call it St. X. The principal contents are *Delesseria* with large, dense coverings of *Campanularia integra*. A colony of *Lafoëina maxima* 9 cm. high. *Calycella syringa* is rare.

St. *96.* 160—180 m. Hard bottom with hydroids. 14 species, none very abundant. There are several rather large colonies of *Lafoëa grandis*. Some of the dense, entangled colonies of *Halecium textum* grow on *Sertularella gigantea*, of which there are several colonies; on the last mentioned there are also some few specimens of *Campanularia groenlandica* which does not occur at any of the other stations. Here also is the only *Thujaria* brought home by the Expedition, namely three colonies of *T. laxa*.

St. *99.* 300 m. Mud with a little gravel. On some cirri of *Hathrometra (Antedon) prolixa* (Sladen) Dr. Th. Mortensen found some

hydrothecae, which I have identified as belonging to the following species: *Lafoëa fruticosa, Calycella syringa, Cuspidella procumbens* and *Stegopoma fastigiatum*; the last-mentioned species was only taken at this station.

St. *104 b.* 200—250 m. Clay and gravel. A small stone with *Lafoëa fruticosa.*

Bathymetric distribution of the species

comp. Tables 2—5.

According to the information given by the Journal as to the nature of the bottom, the algal vegetation seems to cease down towards 100 meters. For this reason I have thought it most correct, in the tables of the bathymetric occurrence of the species, to place St. 95 a where the depth is stated to be ca. 50—100 meters and which contains some *Delesseria*, in the column 60—100 meters; and St. 64 a, where the depth is given as ca. 100 m. and which is without vegetation, in the column 100—200 m. The material from St. X, for which the depth and bottom are unknown, is not included in the tables.

In these tables I have used statements of frequency, as otherwise a wrong impression is obtained of the bathymetric distribution of several species. We may note, for example, that *Lafoëa fruticosa, Cuspidella procumbens* and *Calycella syringa* are certainly found from 6 m. down to more than 200 m., but the great majority of the specimens are found in dephts about 20—40 m.

I use the ordinary signs of frequency: rr = very rare, r = rare, + = neither rare nor common, c = common, cc = very common.

One may perhaps object to these tables, that the material for many species is too small to permit of any conclusions being drawn. This objection is, of course, correct in the case of the really seldom species, but it must be remembered, that the statements of frequency are relative; they are proportionate to the whole material, which is very large. It is quite probable that the species which occur in greatest abundance, are to be found at more stations and at more different depths than the less abundant species; but about the occurrence of the latter certain valid conclusions can be drawn. Thus it may be said, that *Halecium labrosum* and *Coryne eximia* possibly occur in smaller or greater depths than those mentioned, but that they are certainly in the main found in 20—60 m.; and the most important thing is, to find out under what conditions a species thrives best, though it is of course also of interest to know in how small or how great a depth it can be found. On this last point the tables only give reliable information for the commoner species.

Table 3.

	Depth (meters)					
	6—20	20—40	40—60	60—c. 100	c. 100—200	> 200
Lafoëa gracillima	.	+				
Camp. verticillata	.	+				
Garveia groenlandica	.	r				
Rhizogeton nudum	.	r				
Tetrapoma quadridentatum	.	r				
Perigonimus sp.	.	r				
Halecium sp. (tenellum)	.	rr				
Eudendrium tenellum	r	r	+			
Toichopoma obliquum	.	c	c			
Halecium labrosum	.	r	+			
Grammaria immersa	.	r	r			
Campanularia sp.	.	r	r			
Coryne eximia	.	r	rr			
Halecium muricatum	r	c	ccc	+		
Lafoëina maxima	.	r	.	+		
Sertularella tricuspidata	.	ccc	.	r		
Halecium groenlandicum	.	.	.	rr		
Halecium curvicaule	r	r	rr	rr	+	
Lafoëa serpens	r	cc	cc	.	r	
Eudendrium rameum	+	cc	r	cc	r	
Camp. integra	c	ccc	r	c	rr	
Lafoëa grandis	.	r	.	.	c	
Grammaria abietina	.	+	.	.	+	
Camp. volubilis	.	+	.	r	r	
Sertularella gigantea	.	.	.	r	+	
Halecium textum	.	.	.	.	+	
Thujaria laxa	.	.	.	.	+	
Camp. groenlandica	.	.	.	.	r	
Halecium sp. (minutum)	.	.	.	.	rr	
Cuspidella procumbens	+	cc	cc	.	.	rr
Calycella syringa	c	ccc	.	rr	.	rr
Lafoëa fruticosa	+	cc	+	+	+	r
Stegopoma fastigiatum	.	.	.	.	.	rr

Table

Eudendrium tenellum
Halecium muricatum
Halecium curvicaule
Lafoëa serpens
Eudendrium rameum
Camp. integra
Cuspidella procumbens
Calycella syringa
Lafoëa fruticosa
Lafoëa gracillima
Camp. verticillata
Garveia groenlandica
Rhizogeton nudum
Tetrapoma quadridentatum
Perigonimus sp.
Halecium sp. (tenellum)
Toichopoma obliquum
Halecium labrosum
Grammaria immersa
Campanularia sp.
Coryne eximia
Sertularella tricuspidata
Lafoëina maxima
Lafoëa grandis
Grammaria abietina
Camp. volubilis
Halecium groenlandicum
Sertularella gigantea
Halecium textum
Thujaria laxa
Camp. groenlandica
Halecium sp. (minutum)
Stegopoma fastigiatum

4.

Depth (meters)					
6—20	20—40	40—60	60—c. 100	c. 100—200	> 200
r	r	+			
r	c	ccc	+		
r	r	rr	rr	+	
r	cc	cc	.	r	
+	cc	r	cc	r	
c	ccc	r	c	rr	
+	cc	cc	.	.	rr
c	ccc	.	rr	.	rr
+	cc	+	+	+	r
.	+				
.	+				
.	r				
.	r				
.	r				
.	r				
.	rr				
.	c	c			
.	r	+			
.	r	r			
.	r	r			
.	r	rr			
.	ccc	.	r		
.	r	.	+		
.	r	.	.	c	
.	+	.	.	+	
.	+	.	r	r	
.	.	.	rr		
.	.	.	r	+	
.	.	.	.	+	
.	.	.	.	+	
.	.	.	.	r	
.	.	.	.	rr	
.	.	.	.	.	rr

Table 5.

	Depth (meters)					
	6—20	20—40	40—60	60—c. 100	c. 100—200	> 200
Lafoëa gracillima	.	+				
Camp. verticillata	.	+				
Garveia groenlandica	.	r				
Rhizogeton nudum	.	r				
Tetrapoma quadridentatum	.	r				
Perigonimus sp.	.	r				
Halecium sp. (tenellum)	.	rr				
Calycella syringa	c	ccc	.	rr	.	rr
Sertularella tricuspidata	.	ccc	.	r		
Camp. integra	c	ccc	r	c	rr	
Lafoëa fruticosa	+	cc	+	+	+	r
Camp. volubilis	.	+	.	r	r	
Cuspidella procumbens	+	cc	cc	.	.	rr
Coryne eximia	.	r	rr			
Toichopoma obliquum	.	c	c			
Campanularia sp.	.	r	r			
Grammaria immersa	.	r	r			
Lafoëa serpens	r	cc	cc	.	r	
Eudendrium tenellum	r	r	+			
Eudendrium rameum	+	cc	r	cc	r	
Halecium muricatum	r	c	ccc	+		
Halecium labrosum	.	r	+			
Grammaria abietina	.	+	.	.	+	
Lafoëina maxima	.	r	.	+		
Halecium curvicaule	r	r	rr	rr	+	
Halecium groenlandicum	.	.	.	rr		
Lafoëa grandis	.	r	.	.	c	
Sertularella gigantea	.	.	.	r	+	
Halecium textum	.	.	.	.	+	
Thujaria laxa	.	.	.	.	+	
Camp. groenlandica	.	.	.	.	r	
Halecium sp. (minutum)	.	.	.	.	rr	
Stegopoma fastigiatum	.	.	.	.	.	rr

A glance at table 2 will show that, excluding some sparsely represented athecate families, all the families have representatives at practically all depths below 200 meters. With the help of this table we may also compare the bathymetric occurrences of the different species within each single family or genus. Thus, *Sertularella gigantea* lives in deeper water than *S. tricuspidata,* and *Campanularia groenlandica* is the only one of the *Campanularia* species found here which mainly occurs in deeper water.

In table 3 the species are arranged according to the depth of water at which they were taken by the Danmark Expedition. In table 4 they are arranged according to the shallowness of the water in which they were found. It will be easy to grasp the arrangement in detail; where the conditions are the same, regard is taken of the frequency. When species are arranged according to their bathymetric occurrence, it is usual to employ one of these or similar methods. The methods are not without value; it may be of great interest to see what species can occur in this or that shallow or deep water, but as above remarked, the statements are only reliable for the more abundant species. I have nevertheless included here the rare species in order to emphasize the advantage of the method used in table 5. A comparison of the tables 3 and 4 will immediately show, that the order of the species is widely different and that the species which occur at the shallowest depths are in great part the same as those found in greather depths; and that tables such as these say nothing as to what depths the single species belong to. To gain information about this we must examine into the relative abundance of the species at the different depths and judge from that the depth it really belongs to.

The result of my investigation in this direction is represented in table 5. — *Calycella syringa* is found at the same, even at greater depths than *Halecium curvicaule,* but the frequency shows that *C. syringa* is essentially a shallow-water form, whereas *H. curvicaule* evidently prefers deeper water. On the other hand, there is no doubt that *Halecium muricatum* and *H. labrosum* belong to the same depths, but both in table 3 and table 4 they stand far apart; in table 5 we find them together. In the arrangement of the table, regard is taken not only of the depth at which the species has its principal occurrence but also to the frequency with which it occurs at the lesser and the greater depths. *Calycella syringa* as well as *Campanularia integra* have their principal occurrence in 20—40 m.; but *C. syringa* is very rare at greater depths, where *Camp. integra* is still common at 60—100 m.; in the table *C. syringa* must therefore be placed before *Camp. integra.* *Grammaria abietina* occurs in

the same abundance at 20—40 m. and at 100—200 m.; it may then be placed as if it occurs at ca. 80 m. Under equal conditions the species are arranged according to decreasing frequency (cf. the uppermost 7 species in the table).

It is worth noticing, that every one of the frequently occurring species only occur in great abundance within rather narrow limits, while they only occur sporadically at less or greater depths. It might be objected here, that when several species have their principal occurrence in 20—40 m., this may be due to the fact, that most collections have been made at this depth; at the same time it has to be noted, that no species occurs in great abundance in 6—20 m., though we have here 4 stations, whereas *Halecium muricatum, H. labrosum, Eudendrium tenellum* and in part *Cuspidella procumbens, Toichopoma obliquum* and *Lafoëa serpens* have their principal occurrence in 40—60 m., where we have only one station. But there is naturally some right in this objection, as other conditions, temperature, currents, bottom (vegetation), the apparatus used etc., may also have a disturbing influence; this only means, however, that the results of such a table should not be generalized, until we have information of the same kind from many other different localities. This information should preferably be given in tabular summaries, after the principle used in table 5. When the material becomes sufficiently large, the influence of accidental circumstances could be eliminated, and from the available data we could obtain interesting, general results. It would be very desirable, if such investigations could be carried out on a larger scale than hitherto.

The use of the indications of frequency will also give information about the power of the different species to adapt themselves to the outer circumstances. Thus, we can readily see, that *Lafoëa fruticosa* accommodates itself to deeper water more easily than does *Calycella syringa* and *Cuspidella procumbens,* although they all belong to about the same depth.

I shall not go into further details regarding the bathymetric distribution, as the tables are self-explanatory and speak more plainly than words.

If it should happen, that some naturalists take note of the above wish, it is certain that they will not all follow one and the same principle in the subdivision of the depths; each will rather arrange the depths in his own manner; the resulting difficulty of making direct comparisons will, however, scarcely be of great importance. I do not recommend the subdivisions I have used as the most correct; as the depths are given in the Journal of the Expedition (see list of stations), it was impossible to classify them in any other

or better manner; it is fortunate that the subdivisions nevertheless appear natural and reasonable. Further, it is almost the same classification as G. O. Sars has used in "Bidrag til Kundskaben om Norges Hydroider" 1873 (48).

I shall not enter upon a detailed discussion of the influence of the bottom on the distribution of the species. The little the available material shows in this regard will appear from the tables. If we count up the species which occur on the different kinds of bottom, we get the following numbers:

	No. of species	
Only on bottom with vegetation	17	28 on bottom with vegetation
Common for bottom with and without vegetation	11	16 on bottom without vegetation
Only on bottom without vegetation	5	
Total...	33	

Stolonisation

Plate XX and Plate XXI, figs. 1, 2.

It has long been known, that ends of erect branches can grow out in filiform, stolon-like formations and fasten themselves on foreign objects, but not very much has been written about this, only scattered remarks occur here and there.

Occasionally systematic importance has been given the stolonized branches. B. von Campenhausen 1896 (18) p. 306, justly calls attention to the error in this: "Unter den Hydroiden von Ternate zeigen die verschiedensten Genera und Familien - - - Rankenbildung".

Thompson 1884 (55) figures "tendrils" of *Sertularia albimaris* and *Sertularella rugosa*. "How they end and whether they serve for attachment, I do not know" (l. c. p. 5, Pl. I, figs. 1, 10, 13).

Hartlaub 1901 (24), pp. 19, 34—37, 50, mentions some examples in species of *Sertularella*, and expresses the desirability of having at some time a comparative account of these phenomena. Such an account cannot be given here; I only wish to note the examples of stolonisation which I have observed in the material from the Danmark Expedition.

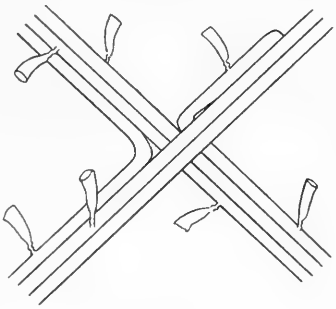
Billard 1901 (10) communicates some observations on stolonisation in different species, mostly in aquaria. Billard has made such stolons attach themselves to glass plates and he has found that they show a very considerable rapidity of growth. About the occurrence of stolonisation in nature it is only said: "- - - les

espèces à stolons se rencontrant généralement sur le littoral", a condition that HARTLAUB also points out.

P. CERFONTAINE 1902 (19) remarks, that ends of branches of *Pennaria Cavolinii* can be transformed to stolons, and stolonized ends from two branches may form anastomoses. GAST & GODLEWSKI 1903 (22) have experimented with the amputation of hydranths and branches of *Pennaria Cavolinii*; from the surface of the wound new hydranths grew out or, if the surface of the wound was in touch with the wall of the aquarium or any other solid object, a stolon. If the outgrowing coenosarc on a regenerating branch came in touch with a solid object, it fastened itself thereon and formed a stolon (p. 83).

I may also mention N. M. STEVENS' experiments, 1902 (53), on *Antennularia ramosa*. Miss STEVENS cut the colony into pieces, placed the pieces in different ways in the aquarium to see how they would regenerate, and found among other things: "Certain parts of the stalk tend to produce roots, others stems. Basal pieces usually produce stems; median pieces roots; and apical pieces, cut within the region of growth, tend to continue the stem. - - - The coenosarc of *Antennularia ramosa* is of such an indifferent character, that it may be withdrawn from one form of growth and put forth in another form without the production of new tissue".

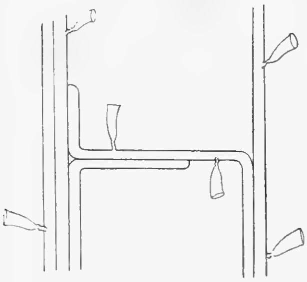
Of greater interest than these phenomena of regeneration under abnormal circumstances, is the occurrence of stolonized branches in nature, and examination of the conditions that lead to their formation. At present I am not able to discuss this subject thoroughly; as said above, I only wish to state here the actual observations I have made. These embrace partly bridges and coalescenses on polysiphonic branches, partly transformation of monosiphonic branches to tendrils and stolons. A polysiphonic branch is in reality a collection of rhizocauli or stolons creeping on one another instead of on a solid support. In polysiphonic species where the peripheral tubes as well as the central may bear hydranths, these tubes are to be considered as rhizocauli analogous to, for example, the creeping stem of a *Calycella*; new tubes are continually developed, which creep along the stem and the branches and cause the growth in thickness of these, but they can also produce a binding together of several branches of the colony. When two compound branches cross each other, some of the new, growing tubes may leave their



Text-fig. 1.

main branch and continue their growth out along the other branch; a mutual exchange of tubes thus occurs, which produces a close and intimate connection between the two, intercrossing branches (text-figure 1); of this I have seen a great many examples in *Lafoëa fruticosa* and *Toichopoma obliquum.*

A young branch, which as yet only consists of one tube, may at its end fasten itself to another branch, grow a little way along this and twine round it like a tendril (Pl. XX, figs. 1, 2); the tendril-like nature of these branches seems in some cases to be determined beforehand, as they bear no hydranths over a long distance before they reach the point of attachment (figs. 2, 4); but I have often seen cases also, where ordinary hydrotheca-bearing branches have fastened themselves to a neighbouring branch (e. g. fig. 1). Two young branches (with or without hydranths) which meet, may unite and form a double bridge between their respective main branches (text-figure 2); from both of these branches new tubes may grow out along the bridge and make this thicker and more solid. I have seen many bridges like this on vigorous, dense colonies of *Lafoëa fruticosa.* Plate XX fig. 3 represents a very strongly developed bridge on an old colony. A single tendril may naturally also form the foundation for a polysiphonic bridge, in that new tubes may grow out on it from both sides.



Text-fig. 2.

Coalescences and bridges of all thicknesses are found in *Lafoëa fruticosa,* of which species the material of the Expedition contains a great many large colonies, and partly in *Toichopoma obliquum* and *Lafoëa grandis.*

I have also seen the transformation of the ends of branches to creeping stolons in the genera *Halecium* and *Sertularella.* In *Halecium* with compound stem I have only observed two such cases; they are both figured on Plate XXI. Fig. 1 shows a branch of *H. muricatum,* which has come into touch with a piece of shell, has fastened itself on this and grown out a stolon on each side. Fig. 2 is a branch of *H. labrosum*; from a hydrotheca there has grown, not a new hydrotheca, but a rather long, somewhat wrinkled thread which has attached itself to a piece of shell and sent out ramified stolons. In *Halecium textum,* whose stems and branches are monosiphonic, branches and pseudohydrocauli[1] are often stolonized and help to

[1] Series of hydrothecae; see Schydlowsky, 1901 (51).

keep the much ramified and entangled colonies together to a coherent web.

In *Sertularella tricuspidata* I have seen a great many examples of stolonisation. In this species the stem and branches are never compound; we might imagine beforehand therefore, that the erect branches had no tendency to form stolons; but in reality we very often find that the end of a branch has continued its growth without forming hydranths and has developed into a long, wrinkled, crooked thread. If the end of such a thread comes into contact with another branch of the colony, it fastens itself on this, twines round it like a tendril (Plate XX, fig. 6) and may leave it again to grow on as a normal hydrotheca-bearing branch. If a stolonized end of a branch comes into contact with a solid object, e. g. a stone (Plate XX, fig. 5), it attaches itself and creeps across the support like an ordinary stolon, which may ramify and send out new hydrocauli. Plate XX, fig. 7 shows a tendril, which has given up seeking for a connecting point and has begun to form hydranths once more; nor is it rare, on an ordinary branch, to see a long, wrinkled piece without hydrothecae, evidently corresponding to a tendril, which has not found a support and has grown on in the normal way (cf. text-fig. 16 in Hartlaub (24)).

As to the importance of the phenomena of stolonisation mentioned and the causes of their formation, I shall only make the following remarks. According to Hartlaub (24), the stolonisation has 3 important functions: The stolons keep the branches together, anchor the colony and spread the species, in that detached pieces can certainly attach themselves at some other places. — The attachment of stolonized branches to solid objects is obviously of advantage in giving the colony new holds. The "bridges" (of the polysiphonic species) and the "tendrils" occur in great abundance on large dense colonies. They give the colony a considerable solidity, so that it is difficult to tear it in pieces; even if a branch is broken at its base, yet it would remain hanging by the tendrils and thus escape the danger of being carried away by currents and the waves and perhaps being thrown up on the land. The tendrils will thus rather counteract a vegetative distribution, but it must be admitted that the power to send out stolons may possibly be a benefit to a detached branch, by fastening it when it again comes under quiet conditions, though it is a question whether the new stolons would not rather in such cases develop from the basal surface than from the ends of the branches.

B. v. Campenhausen, (18) p. 306, also considers the stolonisation

as of importance in the vegetative propagation but in another way: "Einmal dienen die Ranken ganz wie die Luftwurzeln der Pflanzen zur besseren Befestigung des Stockes, das andere Mal zur ungesclecht-lichen Vermehrung wie die Pflanzensprösslinge", in that long tendrils can grow round stones and send up new stems.

A dense matting of *Sertularella* or *Lafoëa* is "as thick as weavers" and the union helps here as everywhere both the single unit of the society and the society as a whole; it is very capable of resistance against forcible encroachment and is able to hold its own, and the colonies will continually grow larger and denser; the bridges and the tendrils will certainly also serve to keep the branches at a suitable distance and prevent them from rubbing too much against each other; if the branches were allowed to do so, they would in the first place become worn, and secondly, no hydranths would thrive except on the outermost branches of the colony; between the dense branches the supply of water would be insufficient and the hydranths would incessantly be driven into their hydrothecae by the rough touch of the neighbouring branches, when the waves set them in motion. The bridges thus serve not only to keep the branches together but also to keep them apart.

In the polysiphonic hydroids the single tubes are by their nature intended to grow on each other; it is not remarkable, therefore, that a tube can also attach itself to a foreign object; but, as above-mentioned, hydranthless threads seem to be developed even here, with the particular purpose of forming a bridge between two branches. The stolonized branch of *Halecium labrosum* figured (Plate XXI, fig. 2) seems also to be intended to become a stolon. That the bridges in *Lafoëa* are most numerous in dense colonies is easily understood; they might be formed from ordinary branches and these in a dense colony have plenty of opportunity of coming into contact with one another. But in *Sertularella* this quite mechanical explanation is not sufficient.

In *Sertularella* the connection always occurs at specially transformed ends of branches, being wrinkled and hydranthless for some (shorter or longer) distance within the connecting point. That these tendrils are only or specially found on large, dense colonies seems to show, that the cause of their formation make be looked for in the shaking, which is produced at the ends of the young branches by frequent contact with the neighbouring branches during the movements of the colony caused by the action of the waves.

In this connection I may also mention, that species with filiform, creeping hydrocaulus may occur with free, erect stems; not only

may the rhizocaulus, when it reaches the edge of the support, grow farther out freely into the water, but the creeping stem may send out free, ramified hydrocauli; of this I have seen several examples in *Lafoëa serpens* (Plate XX, fig. 8).

All these phenomena are the outcome of the slight transition existing between stolon, rhizocaulus and hydrocaulus.

Table 6.

Showing the different supports on which each species has been observed.

	Stones and shells	Algae (mainly Delesseria)	Tunicata	Balani	Echinodermata	Worm tubes	Bryozoa	Coryne eximia	Eudendr. rameum	Hal. muricatum	„ labrosum	„ groenlandicum	„ textum	Lafoëa fruticosa	„ gracillima	Toichop. obliquum	Grammaria abietina	Lafoëina maxima	Sert. tricuspidata	„ gigantea	Camp. verticillata
Rhizogeton nudum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+		
Coryne eximia	+	+	.	.	.	.	+	.	.	+	.	.	.	+	.	+	.	.	+		
Perigonimus sp.	+	+	.	+	.	.	+	.	+	.	.	.	.	+							
Garveia groenlandica	.	+	.	.	.	.	.	.	+	+	.	.	.	+	.	.	.	.	+		
Eudendrium rameum	.	+	.	+	.	.	.	.	.	+	.	.	.	+							
„ tenellum	.	+	.	+	+	.	.	.	+	+	+	.	.	+	+	+					
Halecium muricatum	.	+	+	.	.	+	.	.	+	.	.	.	.	+	.	+	.	.	+		
„ labrosum	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+		
„ curvicaule	.	+	.	.	.	.	.	.	+	.	.	+	.	+	.	+					
„ groenlandicum	.	.	.	.	.	.	+														
„ textum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	
„ sp. (minutum)	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	
„ sp. (tenellum)	.	+																			
Lafoëa fruticosa	+	+	+	+	+	+	+	.	+	+	+	.	.	.	.	+	.	.	+		
„ gracillima	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	+	+	.	+		
„ grandis	.	+																			
„ serpens	.	+	.	.	.	.	+	.	+	+	+	.	.	+	+	+	.	.	+	+	+
Toichopoma obliquum	+	+	+	.	.	.	+	.	+	+	.	.	.	+	.	.	.	.	+		
Grammaria abietina	.	.	.	+																	
— immersa	.	.	.	.	.	.	.	.	.	+											
Stegopoma fastigiatum	.	.	.	.	+																
Cuspidella procumbens	+	+	.	.	+	.	+	+	+	+	+	.	.	+	+	+	.	.	+	.	+
Calycella syringa	.	+	.	.	+	.	.	.	.	+	.	.	.	+	.	+	.	.	+		
Tetrapoma quadridentatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+		
Sertularella tricuspidata	+	+	+	+	.	+	+	.	.	+	.	.	.	.	.	.	+	.	.	.	+
Campanularia integra	.	+	.	+	.	+	+	.	+	+	+	.	.	+	.	+	.	+	+	+	
„ volubilis	.	.	.	.	.	.	+	.	.	+	+	.	.	+	.	+	.	.	+		
„ groenlandica	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	+	
„ sp.	.	+	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	+		
„ verticillata	.	.	.	.	.	.	+														
Summary	6	18	5	7	5	4	11	1	10	15	6	1	1	15	3	12	3	1	15	5	3

Table 7.

Geographical distribution.

	New for Greenland	„ „ East Greenland	Common with West Greenland	„ „ Spitzbergen	„ „ Iceland	„ „ Alaska or Bering Strait	Circumpolar	Most westerly arctic occurrence	„ easterly „ „	Purely arctic species	Arctic species, also found subarctic	Species, alike numerous arctic and subarctic	Subarctic species, also found arctic	Southern, Atlantic species	Cosmopolitan or widely distributed
Rhizogeton nudum	+	+	.	+	.	.	.	18° W	20° E	+					
Coryne eximia	+	+	.	.	+	+	+	160° „	25° „	.	.	.	+		
Garveia groenlandica	.	+	+	.	.	.	.	55° „	18° W	+					
Eudendrium rameum	.	+	+	+	+	.	+	60° „	150° E	.	.	.	.	.	+
„ tenellum	.	+	+	+	.	.	.	18° „	25° „	.	.	.	.	+	
Halecium muricatum	.	.	+	+	+	+	+	160° „	150° „	.	+				
„ labrosum	.	+	+	+	+	.	.	55° „	40° „	.	.	+			
„ curvicaule	+	+	.	+	+	.	.	18° „	20° „	+					
„ groenlandicum	+	+	.	.	.	.	.	18° „	18° W	+					
„ textum	+	+	.	.	.	.	.	18° „	18° „	+					
Lafoëa fruticosa	.	.	+	+	+	+	+	160° „	110° E	.	.	.	.	.	+
„ gracillima	.	.	+	+	+	+	+	160° „	150° „	.	.	.	.	.	+
„ grandis	.	+	+	+	+	.	.	55° „	22° „	.	.	+			
„ serpens	.	+	+	+	+	+	+	160° „	150° „	.	.	.	.	.	+
Toichopoma obliquum	.	+	+	+	.	.	.	55° „	40° „	+					
Grammaria abietina	.	+	+	+	+	.	.	60° „	110° „	.	.	+			
„ immersa	.	.	.	+	+	+	+	160° „	150° „	.	+				
Stegopoma fastigiatum	.	+	+	.	.	.	.	55° „	25° „	.	.	+			
Cuspidella procumbens	+	+	.	.	.	.	.	18° „	18° W	+					
Calycella syringa	.	+	+	+	+	+	+	160° „	150° E	.	.	.	.	.	+
Tetrapoma quadridentatum	.	+	+	+	.	.	.	55° „	150° „	+					
Lafoëina maxima	.	.	+	+	+	.	+	55° „	150° „	+					
Sertularella tricuspidata	.	.	+	+	+	+	+	160° „	150° „	.	+				
„ gigantea	+	+	+	+	.	+	.	160° „	114° „	+					
Thujaria laxa	.	+	+	+	+	.	.	55° „	55° „	.	+				
Campanularia integra	.	+	+	+	+	+	+	160° „	150° „	.	.	.	.	.	+
„ volubilis	.	+	+	+	+	+	+	160° „	55° „	.	.	+			
„ groenlandica	.	.	+	.	+	+	+	160° „	?	+					
„ verticillata	.	+	+	+	+	+	+	160° „	110° „	.	.	+			
Summary	7	22	22	22	19	13	14			11	4	6	1	1	6
percent. of 29 species	24	76	76	76	66	45	45			38	14	20½	3½	3½	20½

Subordo Athecata.

Fam. **Clavidae.**

Genus *Rhizogeton* L. Agassiz.

Rhizogeton nudum Broch.

Broch, 1909 [17], pp. 137 & 191. Textfig. 1.

Some hydranths on *Toichopoma obliquum* and *Sertularella tricuspidata.* Gonophores not observed.

Hab.: St. 71 a.

Depth: 30—40 m.

Geographical distribution: Arctic: Spitzbergen, N. E. Greenland.

Not earlier known from Greenland.

Fam. **Corynidae.**

Genus *Coryne* Gärtner.

Coryne eximia Allman.

Coryne	*eximia*	Allman	1859	[4]	p. 141.	
Syncoryne	„	„	1864	[5]	„ 357.	
„	„	„	1871	[6]	„ 282.	Pl. V.
„	„	Hincks	1868	[28]	„ 50.	Pl. 9, fig. 2.
„	„	Nutting	1901	[45]	„ 166.	Pl. XIV, figs. 3, 4.
Coryne	„	Broch	1909	[17]	„ 193.	

Here and there on *Delesseria,* hydroids etc., I have seen small colonies, most frequently only with 2—3 hydranths, of a *Coryne* which undoubtedly belongs to the above-named species.

Hab.: St. 63, 66, 68 a, 71 a.

Depth: 20—60 m.

Geographical distribution: Arctic: N. E. Greenland, Iceland, Northern Norway, Alaska. — Northern Pacific, Atlantic Europe.

Not earlier known from Greenland.

Fam. **Bougainvillidae.**

Genus *Perigonimus* M. Sars

Perigonimus sp.

From three stations there are a few small, naked, club-shaped hydranths with ca. 7 tentacles, perhaps *P. abyssi* Sars.

Hab.: St. 63, 71a, 94.

Depth: 20—40 m.

Genus *Garveia* Strethill Wright

Garveia groenlandica Levinsen

Plate XXV, fig. 6.

Levinsen 1892 [38], p. 155.

Some small colonies on various hydroids from 3 stations. One colony with very large, female gonophores on a *Eudendrium rameum* from St. 94. — This species has not been found since it was described by Levinsen and it has never been figured.

Hab.: St. 63, 71a, 94.

Depth: 20—40 m.

Geographical distribution: Greenland.

Not earlier known from East Greenland.

Fam. **Eudendriidae.**

Genus *Eudendrium* Ehrenberg.

Eudendrium rameum (Pallas) Johnston.

Tubularia ramea	Pallas	1766 [47]	p. 83.		
„ „	Johnston	1838 [31]	„ 117.	Pl. V, Fig. 1, 2.	
Eudendrium rameum	„	1847 [32]	„ 45.	Pl. V, Fig. 1, 2.	
„ „	Hincks	1868 [28]	„ 80.	Woodcut fig. 8.	
„ „	Allman	1871 [6]	„ 334.		
„ „	G. O. Sars	1873 [48]	„ 129.		
„ „	Allman	1888 [9]	„ 4.	Pl. II, figs. 1, 2.	
„ „	Bonnevie	1899 [13]	„ 51.		
„ *caricum*	Jäderholm	1908 [34]	„ 5.	Taf. I, Fig. 4. Taf. II, Fig. 1.	
„ *rameum*	„	„ „	„ 5.		
„ „	„	1909 [35]	„ 50.	Taf. IV, Fig. 1—2.	
„ „	Broch	1909 [17]	„ 141 & 201.		

Of this widely distributed species a great many large, vigorous colonies are to hand from several stations. The largest colony (St. 95a) is 12 cm. high.

Gonosome: Male gonophores are not rare; they are placed

on well-developed hydranths. Female gonophores are found in great abundance. Normally they grow on the pedicels of well-developed hydranths; in this respect the available material shows certain differences. In 4 cases I have found female gonophores on the body of well-developed hydranths (on two colonies from St. 63). In several cases they are seated on the pedicels of hydranths, but most frequently 2—8 (scattered or more closely together) are on separate, irregularly curved, wrinkled pedicels, which apparently have not borne hydranths. The question is now, have these pedicels nevertheless borne hydranths which have died off about the time for the ripening of the gonophores? I have examined some of the large, prolific colonies from St. 95a. On these colonies the fertile pedicels in some cases bear hydranths, in other cases the perisarc at the distal end of the pedicel shows a hole which indicates, that there has been a hydranth; in still other cases the perisarc seems to be quite closed, but diatoms and detritus prevented me from saying anything definite about the matter. I then took some of these pedicels and cut them into sections with the microtome. The sections show, that the pedicels in question have probably had hydranths; but as the material examined in this way is not large, I cannot say whether all the other gonophore-bearing pedicels have also had hydranths. That the hydranths on the fertile pedicels of *E. rameum* may atrophy, was already noticed by Hincks 1868 (28): "The male gonophores as well as the female are developed from the polypite; but complete atrophy of the latter seems to take place chiefly in the case of the male" (l. c. p. 81). The colonies on which the fertile pedicels are without hydranths completely correspond with *E. caricum* Jäderholm, also in that they show a tendency to ramification in one plane, so that they obtain a fan-shaped habit. *E. caricum* is therefore undoubtedly identical with *E. rameum* (Pallas).

There are two possibilities. 1) Either the fertile pedicels on Jäderholm's specimens have had hydranths, which have all fallen off before the gonophores were ripe; in that case it is not strange, according to the above, that Jäderholm thought he had hydranthless blastostyles before him. 2) Or there have never been hydranths on the fertile pedicels; but this character will not be sufficient for the founding of a new species, as the description of *E. caricum* otherwise corresponds precisely with the specimens of *E. rameum* from the Danmark Expedition.

Hab.: St. 21, 63, 68a, 69, 71a, 94, 95a, 96.

Depth: 6—180 m. most frequent at 20—ca. 60 m.

Geographical distribution: Arctic: circumpolar. — Cosmopolitan.

Eudendrium tenellum Allman.

Eudendrium tenellum	Allman	1877	[8]	p. 8.	Pl. IV, figs. 3, 4.
„ „	Markt.-Turn.	1895	[43]	p. 396.	
„ „	Bonnevie	1898	[12]	„ 7.	Pl. I, Fig. 6.
„ „	Jäderholm	1909	[35]	„ 54.	Taf. IV, Fig. 5—6.

Small colonies, partly with female gonophores, rather often occur on hydroids etc. from several stations. The colour of the chitin is very variable, light or dark yellowish-brown.

The female gonophores agree with Bonnevie's description (12). Miss Bonnevie refers her specimens to this species "- - - um nicht unnöthigerweise die Zahl der Arten zu mehren, - - - obgleich der von ihm [Allm.] beschriebene Hydrocaulus nicht sehr charakteristisch ist - - -". This might be a somewhat unfortunate method, for if the species are not identical, such an identification of them will lead to incorrect statements regarding their geographical distribution. In this case, certainly, no harm has been done, as Marktanner-Turneretscher (43) has already taken up and described Allmann's species, still without knowing the gonophores; it seems that Bonnevie has not observed this.

The female gonophores were found by Bonnevie (12), the male by Jäderholm (35).

Hab.: St. 63, 68a, 71a, 72c, 94.

Depth: 15—60 m., most frequent at 40—60 m.

Geographical distribution: Arctic: Greenland, Spitzbergen, Norway.—West coast of Europe, West Indies.

Not earlier known from East Greenland.

Subordo Thecaphora.

Tribus *Thecaphora conica* Broch 1909.

Fam. **Haleciidae.**

Genus *Halecium* Oken.

Halecium muricatum (Ellis & Solander) Johnston.

Plate XXI, fig. 1.

Sertularia muricata	Ellis & Solander	1786	[21]	p. 59.	Tab. 7, Fig. 3, 4.
Thoa „	Johnston	1838	[31]	„ 121.	Pl. VII, Fig. 3, 4.
Halecium muricatum	„	1847	[32]	„ 60.	Pl. IX, Fig. 3, 4.
„ „	Hincks	1868	[28]	„ 223.	Pl. 43, fig. 1.
„ „	Levinsen	1892	[37]	„ 23.	Tab. I, Fig, 20, 22—27.

Halecium muricatum	Levinsen	1892 [38]	„ 203. Tab. VIII, Fig. 6.
„ „	Schydlowsky	1901 [52]	„ 229.
„ „	Jäderholm	1909 [35]	„ 59. Taf. V, Fig. 4—6.
„ „	Broch	1909 [17]	„ 146 & 203. Textfig. 36, 6.

Of this species, which is common in nearly all arctic seas, a great many, large colonies are to hand, especially from St. 68 a. The largest colony (St. 68 a) is 24 cm. high.

Hydrothecae and internodes are often greatly intertwined, just as in *H. labrosum.* — Regarding the stolonisation see p. 356 and Pl. XXI, fig. 1.

Gonosome: many gonothecae on the larger colonies from St. 63 and 68 a.

Many other species of hydroids grow on *H. muricatum.* On one not very large colony from St. 71 a are the following 8 species: *Coryne eximia* (rr), *Lafoëa fruticosa* (r), *Lafoëa serpens* (rr), *Toichopoma obliquum* (cc), *Cuspidella procumbens* (+), *Calycella syringa* (r), *Sertularella tricuspidata* (cc), *Campanularia volubilis* (r).

Hab.: St. 21, 63, 68 a, 69, 71 a, 95 a.

Depth.: 6—ca. 100 m., most frequent at 40—60 m.

Geographical distribution: Arctic.: circumpolar. — North Atlantic, Europe and America; North Sea; Northern Pacific, America.

Halecium labrosum Alder.

Plate XXI, figs. 2, 3.

Alder	1859 [2]	p. 354. Pl. XIII.
Hincks	1868 [28]	„ 225. Pl. 44, fig 1.
Levinsen	1892 [38]	„ 204. Tab. VIII, Fig. 8—9.
Schydlowsky	1901 [52]	„ 230. Tab. III, fig. 28.
Broch	1909 [17]	„ 148 & 203. Textfig. 3 c., 7, 8. Taf. II, Fig. 4.

Some colonies of this species occur from two stations. A single case of stolonisation observed (see p. 356 and Pl. XXI, fig. 2). A colony with very long hydrotheca pedicels is to hand from St. 68 a; a peculiarly long-stalked hydrotheca is figured on Pl. XXI, fig. 3.

Gonosome: some of the larger colonies from St. 68 a are densely covered with female gonothecae.

Hab: St. 68 a, 71 a.

Depth: 30—60 m.

Geographical distribution: Arctic: Greenland, Iceland, Spitzbergen, White Sea. — Atlantic, Europe and North America; Mediterranean.

Not earlier known from East Greenland.

Halecium curvicaule v. Lorenz.

Plate XXI, fig. 4.

v. Lorenz 1886 [41] p. 27. Taf. II, Fig. 3, 4.
Jäderholm 1908 [34] „ 16. Taf. II, Fig. 19—20.
Broch 1909 [17] „ 150 & 204, Textfig. 9, 10, 11. Taf. II, Fig. 2.

Of this purely arctic species some small colonies are to hand from 4 stations. The three largest colonies (St. 96) have the following height, 3.2, 3.5, 4.0 cm.

The proximal bending of the pedicel of the hydrotheca is not always abrupt, often indeed very slight. Characteristic is the sharp constriction of the lower part of the pedicel; this constriction is also distinctly seen in Broch's figures, less distinctly in v. Lorenz' and Jäderholm's. In his original description v. Lorenz states, that the perisarc is of a brownish colour; in the specimens of the Danmark Expedition it is perfectly colourless and hyaline.

Gonosomes not present.

Hab.: St. 21, 63, 68a, 96.

Depth: 6—180 m., the largest colonies at 160—180 m.

Geographical distribution: Arctic: North-East Greenland, Iceland, Jan Mayen, Spitzbergen, Murman Sea.

Not earlier known from Greenland.

Halecium groenlandicum n. sp.

Plate XXII.

On a Bryozoan is a characteristic rhizome (Pl. XXII, fig. 1), the branches of which sometimes creep closely over the support, sometimes rise somewhat from it and ramify greatly, often almost at right angles; the branches often bend downwards and attach themselves on to the support, to leave it soon again; often the branches also fasten themselves to each other, so that a web of intertwined, densely ramified tubes is formed. These tubes bear single hydrothecae, which might form pseudohydrocauli (Schydlowsky's name for rows of hydrothecae (51)), and large, oblique gonothecae, often opposite in pairs (fig. 4). From the rhizome also issue erect, compound stems. A little way up on the largest stem there is a bundle of intertwined, densely ramified tubes with hydrothecae and gonothecae just as on the rhizome (fig. 2); this bundle issues from the tubes of the stem at several different places. The erect stems consist of several, parallel, in part somewhat intertwined tubes, which communicate at several places (see fig. 2), and which by and by bend outwards to form branches. These are straight, not zigzag, and smooth

or with slight traces of a spiral winding over the hydrothecae. The primary hydrotheca is borne by a short projection from the branch (fig. 3); the length of the hydrotheca + that of the pedicel is nearly twice the diameter of the aperture; smooth or at most with a slight constriction proximally. Every primary hydrotheca forms a pseudohydrocaulus of, as a rule, short-stalked calycles, often 6—7, even up to 9 inside each other. The hydrothecae are very short and have a circle of numerous chitinous warts very near to the slightly everted rim. The diameter of the aperture is ca. 250 μ. — The chitin is brownish coloured. The hydranths are very badly preserved.

The gonothecae (fig. 4) are rather large, hyaline, sack-shaped, very oblique, with a small round aperture on a slightly projecting spout, which as a rule turns somewhat inwards towards the branch. Height without the short, smooth pedicel ca. 550 μ, height with the pedicel ca. 700 μ; breadth ca. 725 μ. All the gonothecae are empty.

Of this species, which I have not been able to refer to any of the many *Halecium* species hitherto known, I have seen a single colony, 24 mm. high, on a Bryozoan, which I have unfortunately not been able to get identified.

Hab.: St. 95 a.

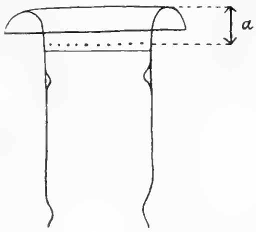
Depth: ca. 50—100 m.

Halecium textum n. sp.

Plate XXI, figs. 5, 6.

From filiform stolons issue a great many, finely shaped hydrocauli, which ramify greatly, and the outspread branches are so interwined, that densely entangled masses are formed. The ends of the pseudohydrocauli as well as the ordinary branches are often stolonized and attach themselves to other branches, so that the entangled colonies can scarcely be separated from each other. In spite of the confused appearance of the colonies, there is a certain regularity in the ramification. Every branch ends in a hydrotheca (which often forms a pseudohydrocaulus); below the base of this two branches usually rise at a slightly different height; they issue at a wide angle from the mother-branch, but have a slight proximal bending so that the angle becomes about 45°. The two side-branches do not lie in the same plane; if we imagine two planes through the mother-branch and the two side-branches, these planes will form an angle of about 120° with each other. Let us suppose, that the space between these two planes looks forwards (towards the onlooker), the hydrotheca will then usually have a bend backwards. Each of the side-branches bears a terminal hydrotheca and a pair of branches

with similar angles to those above-mentioned, but the space between the planes of the side-branches here looks backwards, the terminal hydrotheca is bent forwards and so on. — There are not a few divergences from this rule, however; not seldom there is only one side-branch, more seldom three. The branches are mostly smooth; at their distal part there are hourglass-shaped constrictions. All the branches are of about the same thickness, ca. 110μ, their length is somewhat variable, on an average ca. 1.2 mm. — The pedicels of the secondary hydrothecae are of different length, at the base consisting of one or more hourglass-shaped nodes or with more irregular constrictions, sometimes only with a single ring-shaped constriction; the distal part is smooth. The hydrothecae are short, the rim very much everted and bent backwards; ca. 20 chitinous warts; the average distance of these from the uppermost part of the aperture (the distance a in text-figure 3) is 34μ, i. e. ca. $^1/_5$ of the diameter of the rim. Nearly as far (on an average 32μ) under the chitinous warts there is always a well-developed pseudodiaphragm in the form of a closed ring, equally developed on all sides. The diameter of the free rim of the aperture is on an average 164μ, that of the proximal part of the hydrotheca (at the chitinous warts) ca. 106μ. — The chitin has a light brownish colour. The hydranths are very badly preserved.



Text-fig. 3.

Gonothecae are not present.

The species described here has some resemblance to Jäderholm's figure of *Halecium tenellum* Hincks (1909 (27), Taf. IV, fig. 12). Yet I can scarcely believe that the specimens belong to *H. tenellum.* Against such a view is the constant possession of a pseudodiaphragm, the shortness of the hydrotheca, the rather great thickness of the branches and the stalks in proportion to the diameter of the rims of the hydrothecae, and the characteristic habit of the entangled branches spread out in all directions. Unfortunately I have no northern material of *H. tenellum* at my disposal, otherwise measurements would most likely be able to decide the question, if it is a variety of *H. tenellum* or an independent species, for which I would then propose the name *Halecium textum.*

Of this species there is a by no means small material from St. 96, in part growing on *Sertularella gigantea.*

Hab.: St. 96.

Depth: 160—180 m.

Halecium sp. (**tenellum** Hincks aff.)
Plate XXIII, figs. 1, 2.

The hydrocauli issuing from the filiform stolon are very fine and hyaline; not more than 0.55 cm. high, with few, slender branches, which at all events in their distal part are divided into hourglass-shaped nodes by alternately sharp and less sharp constrictions; every branch rises either in or closely under a hydrotheca, and they all lie nearly in the same plane. The hydrothecae are small, with very much everted rim, diameter ca. 0.19 mm.; the distance from the rather few chitinous warts to the aperture is about a third of the diameter of the rim.

Gonosomes are not present.

The specimens to hand have a great likeness to *H. tenellum* Hincks.

Compare: Hincks 1868 (28) p. 226. Pl. 45, fig. 1.
Jäderholm 1909 (35) p. 55. Taf. IV, Fig 12.

Of this beautiful little species a few small sterile colonies on *Delesseria* are to hand.

Hab.: St. 63.

Depth: 20—40 m.

Geographical distribution of *H. tenellum*: Arctic: West Greenland, Jan Mayen, Iceland, White Sea, Kara Sea. — Cosmopolitan.

Halecium sp. (**minutum** Broch aff.)
Plate XXIII, figs. 3, 4.

The erect hydrocaulus is 0.44 cm. high; ca. 0.25 mm. below each hydrotheca there is a ring-shaped constriction, otherwise the hydrocaulus is quite smooth with some slender branches. The small hydrothecae have a very much everted rim (diameter ca. 0.15 mm.); the distance from the chitinous warts to the aperture is about $^2/_5$ of the diameter of the rim.

Gonosomes are not present.

Compare: Broch 1903 (14) p. 4. Taf. I, Fig. 1—4.
" 1909 (17) p. 153. Textfig. 13, 14, 15.

Of this species only a single colony on *Sertularella gigantea* is to hand.

Hab.: St. 96.

Depth: 160—180 m.

Geographical distribution of *H. minutum*: Arctic: Spitzbergen, Iceland. — North Atlantic, Europe.

Fam. **Lafoëidae.**

This family is nearly related to the following. It is characterized by the gonothecae being grouped together in aggregates. In

most cases the gonothecae are firmly bound to each other, forming a "Coppinia", more rarely the connection is of a looser nature; the latter form, "Scapus", indicates a transition to related forms with separated gonothecae. — *Toichopoma obliquum,* the gonosome of which is described here for the first time, must be referred to the *Lafoëidae,* as its gonosome is a typical Coppinia; it is thus the only operculated member of the family.

Genus *Lafoëa* (Lamouroux).

Lafoëa fruticosa M. Sars.

Plate XX, figs. 2, 3.

Campanularia	fr.	M. Sars	1851 [49]	p. 138.	
Lafoëa	„	„	1862 [50]	„ 6.	
„	„	Hincks	1868 [28]	„ 202.	Pl. 41, fig. 2.
„	„	G. O. Sars (i. p.)	1873 [48]	„ 114.	Tab. IV, fig. 16.
„	„	Hincks	1874 [29]	„ 148.	Pl. VI.
„	„	Thompson	1884 [56]	„ 7.	Pl. I, fig. 17.
„	„	Levinsen	1892 [38]	„ 171.	Tab. VII, Fig. 1—5.
„	„	Bonnevie	1899 [13]	„ 64.	Tab. V, fig. 2 b, 3.
„	„	Broch	1906 [16]	„ 35.	Textfig. 4.
„	„	Jäderholm	1908 [34]	„ 14.	Pl. II, Fig. 16.
„	„	„	1909 [35]	„ 73.	Taf. VII, Fig. 9.
„	„	Broch	1909 [17]	„ 158 & 208.	Textfig. 19.

Numerous from a great many stations, but it is only found in great abundance at St. 63. The largest colony (St. 63) is 10 cm. high.

I have only seen hydrothecae renovated once. — There can be as many as 9 windings on the pedicel of the hydrothecae. — Bridges and coalescences between the branches occur frequently in vigorous, compact colonies (cf. p. 355—356).

Gonosomes fairly frequent (St. 21, 63, 95 a).

Hab.: St. 21, 63, 64 a, 68 a, 69, 71 a, 72 c, 94, 95 a, 96, 99, 104 b.

Depth: 6—300 m.

Geographical distribution: Arctic: circumpolar. — Greater part of the Northern Hemisphere.

Lafoëa gracillima (Alder) G. O. Sars.

Campanularia	gracillima	Alder	1856 [1]	p. 129.	Pl. VI, figs. 5, 6.
Lafoëa	„	G. O. Sars	1873 [48]	„ 115.	Tab. IV, fig. 19—21.
„	fruticosa	Hincks	1874 [29]	„ 148.	Pl. VI & VII.
„	„	Thompson	1884 [56]	„ 7.	Pl. I, fig. 18.
„	„	Allman	1888 [9]	„ 34.	Pl. XVI, fig. 2.

Lafoëa gracillima	Bonnevie	1899 [13]	p.	64.	Tab. V, Fig. 2 a.
„ „	Sæmundsson	1902 [54]	„	60.	
„ „	Broch	1906 [16]	„	37.	Textfig. 5.
„ „	Jäderholm	1908 [34]	„	13.	Pl. II, Fig. 15.
„ „	„	1909 [35]	„	74.	Taf. VII, Fig. 6—8.
„ „	Broch	1909 [17]	„	156 & 208.	Textfig. 17, 18.
„ „	Sæmundsson	1911 [55]	„	84.	

Rather numerous at St. 71 a. The largest colony is 2.5 cm. high.

There have been divided opinions as to the independence of this species from *L. fruticosa*; whilst some authors maintain, that the two species are always easily distinguished, others hold that they grade evenly into one another. The specimens of *L. gracillima* from the Danmark Expedition are not difficult to distinguish from *L. fruticosa*. Several have pointed out, that neither the number nor the form of the windings on the hydrothecal stalk is a reliable mark of recognition. In the present material I have found even 7 spiral windings on the pedicels.

Hab.: St. 71 a.

Depth: 30—40 m.

Geographical distribution: Arctic: circumpolar. — Cosmopolitan.

Lafoëa grandis Hincks.

Plate XX, fig. 1.

L. fruticosa	G. O. Sars	1873 [48]	p.	114.	Tab. IV, fig. 17, 18.
„ grandis	Hincks	1874 [29]	„	148.	Pl. VI, figs. 1, 2.
„ „	Thompson	1884 [56]	„	7.	Pl. I, fig. 16.
„ symmetrica	Bonnevie	1899 [13]	„	64.	Tab. V, Fig. 2 c, 4.
„ „	Billard	1907 [11]	„	176.	Textfig. 6.
„ fruticosa	Jäderholm	1907 [33]	„	3.	Taf. I, Fig. 1, Taf. II, Fig. 1.
„ grandis	„	1909 [35]	„	72.	Taf. VII, Fig. 10.
„ symmetrica	Sæmundsson	1911 [55]	„	83.	

Several small and large colonies, the largest (St. 96) 5 cm. high.

In descriptions of this species stress is generally laid on the symmetrical form of the hydrotheca; this character does not correspond with the specimens of the Danmark Expedition, on which all the hydrothecae show an obliquity or bending to one or the other side (not always away from the branch as in *L. fruticosa*); this obliquity is rather slight on some hydrothecae but on most of them it is very obvious, in the same way as in *L. fruticosa*. The specimens correspond in every way to Hincks' original description and

figure (29). — Jäderholm (1907 (50)) mentions and figures some very large hydrothecae (1.02—1.08 mm.), which on account of their oblique form he refers to *L. fruticosa*; the description and the figures correspond completely to the above-mentioned specimens from the Danmark Expedition, and like these belong undoubtedly to *L. grandis*.

Some of the colonies from St. 71 a occur on a leaf of *Delesseria*, intermingled in a thick matting of *Toichopoma obliquum*.

Hab.: St. 71 a, 96.

Depth: 30—180 m., most frequent at 160—180 m.

Geographical distribution: Arctic: Greenland, Iceland, Norwegian Sea, Barents Sea. — Western Europe as far as Morocco.

Not earlier known from East Greenland.

Lafoëa serpens (Hassall) Bonnevie.

Plate XX, fig. 8.

Campanularia	serpens	Hassall	1848	[25]	p. 2223.	
„	„	„	1852	[26]	„ 163.	Pl. XXI, fig. 4.
Reticularia	„	Alder	1856	[1]	„ 130.	
Filellum	„	Hincks	1868	[28]	„ 214.	Pl. 41, fig. 4.
Lafoëa	„	Bonnevie	1899	[13]	„ 63.	Tab. V, Fig. 4.
Filellum	„	Jäderholm	1909	[35]	„ 76.	Taf. VII, Fig. 11.
„	„	Broch	1909	[17]	„ 160 & 210.	Textfig. 21.
„	„	Sæmundsson	1911	[55]	„ 85.	

This widely distributed species is very abundant at several stations, in the main on hydroids.

Renovation of the hydrothecae may occur up to 3 times; the freely projecting part of the new hydrothecae is of very variable length and often crooked in another direction than the primary hydrotheca so that the planes of the old and new aperture form a considerable angle with each other.

Not rarely the stolon rises from the support and forms an erect stem, which may even ramify and bear many hydrothecae (see p. 358—359 and Pl. XX, fig. 8).

Gonosomes only observed on material from St. 68 a.

There does not seem to me sufficient reason for retaining *Filellum serpens* as a separate genus. The decumbent, growing part of the hydrotheca may be so short, that great similarity with *Lafoëa dumosa* arises, and that the stem is creeping or almost always so is an insufficient generic character, especially among these forms where the erect stem is a rhizocaulus. Through *Lafoëa dumosa, Filellum serpens* is so nearly related with the genus *Lafoëa*, that it should be included in the latter.

Lafoëa serpens does not seem to agree with *Cuspidella procumbens*; if they occur together, one of them is always in great preponderance, or the two species keep to separate parts of the hydroid colony or of the leaf of seaweed on which they are growing.

Hab.: St. 21, 63, 64 a, 68 a, 71 a, 72 c, 96.

Depth: 6—180 m., most frequent at 20—60 m.

Geographical distribution: Arctic: circumpolar. — East Atlantic as far as Cape Verde. Eastern and western coasts of America as far as Tierra del Fuego. Hawaii.

Not earlier known from East Greenland[1].

Genus *Toichopoma* Levinsen.

Toichopoma obliquum (Hincks) Levinsen.

Plate XX, fig. 4. Pl. XXIII, figs. 5—8. Pl. XXIV, fig. 1.

Calycella obliqua	Hincks	1874 [29]	p. 149. Pl. VI, figs. 4, 5.
Toichopoma obliquum	Levinsen	1892 [38]	„ 176 & 178.
„ „	Broch	1909 [17]	„ 159 & 210. Textfig. 20.

This purely arctic species is rather numerous at some few stations in fairly shallow water. The largest colony (St. 71 a) is 7.5 cm. high.

The operculum is formed of the upper part of the wall of the hydrotheca. Its developmental history is the following. In its early stages the hydrotheca looks quite like that in *Lafoëa fruticosa*, but at a certain period, ere the original, thin roof of the hydrotheca undergoes a change, a curved line appears on the upper part of the hydrotheca, corresponding to the boundary of the later operculum

[1] *Filellum* (?) *expansum* Levinsen (38) p. 172, Tab. VII, Fig. 6—7, was set up under the reservation, that „det er meget muligt, at de [Rørene] med Tiden ville vise sig at tilhøre en Art af Slægten *Folliculina* eller af en nærstaaende Slægt" ("it is quite possible that they [the tubes] will prove in time to belong to a species of the genus *Folliculina* or of a nearly related genus"). This species is found in great numbers on leaves of *Delesseria* and such like from the Danmark Expedition. I have often seen it with the two ciliated lobes characteristic of *Folliculina* stretched out of the tubes, so that the reference of the species to the genus *Folliculina* is certain. Levinsen has asked me to communicate this here.

Filellum (?) *expansum* Levinsen will thus take the name:

Folliculina expansa (Levinsen).

It is mentioned as hydroid at the following places:

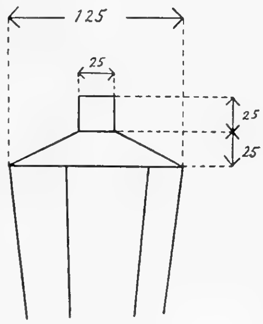
Filellum (?) *expansum*	Levinsen	1893 [39]	p. 382.
Filellum expansum	Hartlaub	1899 [23]	p. 113.
Lafœa expansa	Billard	1907 [11]	p. 179.
Filellum expansum	Jäderholm	1909 [35]	p. 77, Taf. 7, Fig. 12.

The species is thus known from: West Greenland (Lev.), North-East Greenland (Danmark Expedition), Spitzbergen (Jäderholm), Kara Sea (Lev.), Denmark (Lev.), Bohuslän, Sweden (Jäderholm), Eastern North Sea (Hartlaub), Cadiz Bay (Billard).

(Pl. XXIV, fig 1). When the hydranth retreats from the wall to develop its tentacles, the operculum follows, and at the same time the roof of the hydrotheca crumples up and is thrown off at once or later. On some hydrothecae, in which the tentacles of the hydranth were not yet completed, I have opened the operculum artificially, and in some cases I have seen its rim to be quite free, the roof thrown off and the hydrotheca thus quite complete; in other cases the roof remains as a crumpled mass, which is totally thrown off when the completed hydranth comes out. — The operculum is generally external, but it may also be internal or lateral.

Stolonisation (bridges, coalescences and tendrils) occurs here in the same way as in *Lafoëa fruticosa* (see p. 355—356 and Pl. XX, fig. 4).

Gonosome: I have found the hitherto unknown gonosome on two colonies from St. 71 a. It is a typical "Coppinia". The gonothecae (text-fig. 4.) are 5—6 cornered, ca. 125 μ diagonally; their free surface is broadly conical, ca. 25 μ high; then from the middle rises a cylindrical neck, 25 μ high and 25 μ in diameter; on gonothecae which touch one of the long, narrow hydrothecae, the mouth is not in the middle but close in towards the hydrotheca (Pl. XXIII, fig. 7). These gonothecae are connected into oblong masses on the branches, 1.5—2 mm, in diameter, ca. 10 mm. long (Pl. XXIII, figs. 5, 6). The hydrothecae between the gonothecae are long, thin (diameter ca. 90 μ), and strongly, but regularly curved in such a manner that they form a mantle, ca. 0.75 mm. thick, round about the gonothecae and of almost the same denseness everywhere. The whole Coppinia thus has a diameter of ca. 3 mm. It is of special interest, that the long, thin hydrothecae mentioned are provided with an operculum of quite the same construction as in the normal hydrothecae (Pl. XXIII, fig. 8). The wall of the Coppinia hydrothecae is as a rule somewhat thickened on the concave side.



Text-fig. 4.

We thus have evidence, that *Toichopoma* belongs to the family *Lafoëidae,* in which Broch (17) has also placed it, but only for the following reasons, "- - - die einzige bekannte Art zeigt in ihrem Bau so unzweifelhafte Beziehungen zu der Gattung *Lafoëa,* dass sie ihre nächsten Verwandten hier sucht". Broch is further of the opinion, that *Toichopoma* cannot perhaps remain as a separate genus, but is a species of the genus *Lafoëa.* I think, however, that the presence of an operculum makes *Toichopoma* so distinct from the other *Lafoëidae,* that there is sufficient reason for retaining Levinsen's generic name.

Hab.: St. 63, 68 a, 69, 71 a.

Depth: 20—60 m.

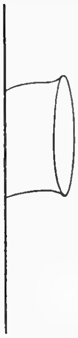
Geographical distribution: Arctic: Greenland, Murman Sea, Spitzbergen.

Not earlier known from East Greenland.

Genus *Grammaria* Stimpson.

Grammaria abietina M. Sars.

Campanularia	abietina	M. Sars	1851 [49]	p. 139.	
Grammaria	ramosa	Alder	1856 [1]	„ 130.	Pl. VI, fig. 1—4.
„	abietina	M. Sars	1862 [50]	„ 11.	
Salacia	„	Hincks	1868 [28]	„ 212.	Pl. 41, fig. 3.
Grammaria	„	Levinsen	1892 [38]	„ 162 & 173.	Tab. V, Fig. 20.
Lafoëa	„	Bonnevie	1899 [13]	„ 64.	Tab. V, Fig. 6.
Grammaria	„	Broch	1909 [17]	„ 161 & 210.	Taf. III, Fig. 8.


Text-fig. 5.

Several large and small colonies; the largest (St. 71 a) is 9 cm. high.

The hydrothecae often renovate 5 times. The aperture is always straight, not oblique and the rim always a little everted (text-fig. 5). The branches are as a rule constricted proximally (consisting of one tube). In Broch's figure (17) the aperture in most of the hydrothecae is oblique and the rim not at all everted.

Gonosomes were found on a colony from St. 96, corresponding precisely to the descriptions and figures of Levinsen and Bonnevie.

Hab.: St. 71 a, 96.

Depth: 30—180 m.

Geographical distribution: Arctic: Labrador, Greenland, Iceland, Norwegian Sea, Spitzbergen, north coasts of Europe and Asia as far as East Taimur. — North Atlantic, Europe and America.

Grammaria immersa Nutting.

Nutting	1901 [45]	p. 178.	Pl. XXI, figs. 5, 6.
Jäderholm	1907 [33]	„ 4.	Taf. II, Fig. 4.
„	1908 [34]	„ 14.	Pl. II, Fig. 17—18.
Broch	1909 [17]	„ 161 & 211.	Taf. III, Fig. 6.

Some rather small colonies, in part with several side-branches; the largest (St. 71 a) is 2 cm. high and has 5 lateral branches.

Broch (17) remarks as specially characteristic, that the ends of the branches are rounded in this species in contrast to *G. abietina* ("Die meist charakteristischen, trennenden Merkmale unserer nördlichen *Grammaria*-Arten scheinen an den Zweigspitzen gefunden zu werden".---

"Die Zweigspitze dieser Art [*G. immersa*] zeigt einen regelmässigen parallelen Zuwachs sämtlicher Tuben, so dass sie im Gegensatz zu der vorhergehenden Art ein regelmässig abgerundetes Ansehen bekommt (Taf. III, Fig. 6)"); — but this does not always hold good. On the other hand, the form of the hydrothecae seems to be characteristic. In *G. abietina* they are strongly bent, cut off square at the end and with a slightly everted rim. In *G. immersa* the rim of the aperture is not everted, and the hydrothecae are less bent, obliquely cut off at the end in such a manner, that the plane of the aperture is parallel with the direction of the branches (Text-fig. 6), which in *G. abietina* is attained by the greater curvature. When a hydrotheca of *G. immersa* grows further out than usual, the plane of the aperture will form a small angle with the direction of the branches, the aperture thus facing somewhat downwards (text-fig. 6). — It may be mentioned further, that *G. immersa* is smaller and more slender than *G. abietina*, and that the free end of the hydrotheca is usually shorter; in the specimens to hand the branches are always constricted proximally. — In his original description (45) NUTTING says: "The distal ends of the hydrothecæ are abruptly bent outward, so that the round, even aperture is vertical", and he figures a piece of a branch to illustrate this. As mentioned above, the vertical position of the aperture is attained in the specimens of the Danmark Expedition not only by the bending but also by the aperture being cut off obliquely. — In spite of these differences from the descriptions and figures of NUTTING and BROCH, there is no doubt that the specimens of the Danmark Expedition really belong to the species *G. immersa* Nutting, as they agree in all other respects with NUTTING's clear and detailed description. Further, they agree with JÄDERHOLM's descriptions and figures (33) and (34); though in JÄDERHOLM's specimens the branches are not always constricted proximally.

Text-fig. 6.

The colonies from St. 68 a occur on a large colony of *Halecium muricatum*.

Hab.: St. 68 a, 71 a.

Depth: 30—60 m.

Geographical distribution: Arctic: circumpolar. — Northern Pacific, America.

Fam. **Campanulinidae.**

Investigations on the structure and development of the operculum.

The family *Campanulinidae* may be characterized as *Thecaphora conica*, the hydrothecae of which, at least in their distal part, are

polysymmetrical and can be closed by an operculum, and the gonothecae of which are attached singly, not in aggregates. — In *Stegopoma* we have only two planes of symmetry, in *Tetrapoma* four planes, in the other genera more. — All other operculated hydroids are bilaterally symmetrical and have only one plane of symmetry; this is a very important characteristic for the whole family *Sertularidae*; on the other hand, the bilateral form in *Toichopoma*, the only operculated genus among the *Lafoëidae*, is of less systematic importance. Nor is it this character which distinguishes *Toichopoma* from the *Campanulinidae*, but the possession of a "Coppinia".

The structure of the operculum in the *Campanulinidae* has been but little investigated and has been misunderstood in several ways. — The pyramidal operculum was considered for a long time to consist of free, triangular valves (see e. g. HINCKS (28) Pl. 38). A more correct view was first given in 1892 in the two papers of LEVINSEN (37) and (38). LEVINSEN described the different forms of operculum and divided the genus *Calycella* into 4 genera: *Calycella, Tetrapoma, Stegopoma* and *Toichopoma*. Of these *Toichopoma* is mentioned among the *Lafoëidae*; to the descriptions of *Stegopoma* and *Tetrapoma* there is nothing to add. With regard to the many-sided opercula (with more than four facets) LEVINSEN has shown, that they close by folding, except in *Lovenella* where the operculum consists of free valves. I have not investigated *Lovenella* myself and have no opinion, as to how far it is correct of BROCH to include this genus with *Tetrapoma*. — In the other genera LEVINSEN described the operculum as consisting of triangular facets, between which there are thinner, chitinous parts, which on closing are folded inwards and are more or less apt to split.

LEVINSEN's view of the development of these opercula was as follows. The young hydrotheca is closed by a roof; in this appears at a certain time a number of radiating lines, which do not reach in to the centre of the roof; when the full-grown hydranth pushes out, the central part of the roof will be thrown off, and the remainder will become the above-described operculum. LEVINSEN certainly understood, that in *Cuspidella, Lafoëina, Opercularella* and *Campanulina*, the operculum is not marked off from the calycle by any edge ((38) p. 176); but this means, that in the genera mentioned the r o o f of the hydrotheca is not separated from the calycle by any edge, in this sense we can understand the emphasized sentence ((37) p. 16): "I alle Tilfælde opstaar Laaget ved en Omdannelse af Hydrothekets oprindelige Tag", that is, in all hydroids except *Toichopoma* and *Stegopoma* the operculum arises by a transformation of the original roof of the hydrotheca. In fact, the roof in the *Campanuli-*

nidae is already distinct from the calycle at an early stage in development, and we shall see later, that the roof in *Cuspidella* etc. does not take part in the formation of the operculum.

No other view of the operculum in the *Campanulinidae* has appeared, so far as I know (I exclude SCHNEIDER's criticism (51)), until BROCH published his paper in 1909 (17). BROCH maintains, that the operculum in all *Campanulinidae* is formed by the upper part of the lateral wall of the hydrotheca, but for the rest he retains the triangular facets. BROCH sets up, — as an hypothesis I admit — the following phylogenetic series: *Lafoëa, Toichopoma, Stegopoma, Cuspidella*[1] (the thin parts between the facets do not split), *Campanulina* and *Calycella* (the thin parts split more or less), *Tetrapoma*[2] and *Lovenella* (the thin parts present in early stages, but completely fall off).

As almost all these genera are represented in the material of the Danmark Expedition, I have undertaken an investigation, with the following results.

Cuspidella. — On examining a fully developed hydrotheca of *Cuspidella* with closed operculum, we notice that the operculum is not usually separated by any edge from the hydrotheca (Pl. XXIV, fig. 2); yet a distinct edge can be present, though seldom (Pl. XXIV, fig. 6), and this fact has induced BROCH to unite *Cuspidella* and *Campanulina* with *Calycella*; in the last the operculum is always marked off from the lateral walls of the hydrotheca by a sharp edge. — If we press on the operculum of a *Cuspidella* and open it (Pl. XXIV, fig. 5), we will see that it is a direct continuation of the hydrothecal wall, that the opened aperture is circular and of the same diameter as the hydrotheca, and that the aperture-rim is complete; if there was a distinct edge between the operculum and the calycle before, this edge will now show itself as a quite faint line. Triangular facets are sought for in vain; on the other hand, a few lines will be seen, which begin at about the same height on the hydrothecal wall and run parallel up towards the rim of the aperture; before reaching this, they bifurcate but the two prongs do not diverge greatly, the part between is complete and its free margin enters into the formation of the above mentioned unbroken rim of the aperture. By means of these parts the "facets" with their broad ends can fold over one another, so that the closed operculum becomes conical. There is not the slightest doubt, that the operculum in *Cuspidella* is a direct continuation of the hydrothecal wall, and has arisen by a

[1] ***Cuspidella, Campanulina, Opercularella*** and ***Calycella*** are united under the name ***Campanulina.***

[2] ***Tetrapoma*** and ***Lovenella*** are united under the name ***Lovenella.***

transformation of the upper part of this, just an BROCH has described. — But to obtain complete proof, we must follow the ontogenetic course of development.

The young hydrotheca (Pl. XXIV, fig. 3) ends in an aperture with entire rim which is closed by a thin roof, already distinct from the lateral wall; there is as yet no indication of the operculum. At later stages we find the above-described lines; no folding can yet be seen and the roof is still unbroken (Pl. XXIV, fig. 4). When the hydranth withdraws from the wall to form its tentacles, the operculum accompanies it, presumably because the latter is still in close connection with the hydranth, and will thus begin to fold up; as a result the thin roof will be ruptured, perhaps falling off at once or perhaps remaining for a time as a crumpled mass, just as in *Toichopoma* (see p. 375); if the roof is not thrown off beforehand, it will naturally fall off when the completely formed hydranth extends. It may happen that the operculum, when withdrawn as above-mentioned, is pulled right into the hydrotheca; in such cases a distinct edge appears as the lower boundary of the operculum; this edge is thus a secondary phenomenon without fundamental importance.

Calycella. — The operculum in *Calycella* is separated from the hydrothecal wall by a sharp edge, which projects somewhat as a rule, and which is seen to be thickened when the operculum is open. If we open the operculum, we find that it is a cylindrical membrane with a number of parallel, vertical lines; the rim of the membrane is scalloped in correspondence with these lines; the tongues are angular (Pl. XXIV, figs. 12, 13) or rounded (Pl. XXIV, fig. 11); the depth of the indentations between may vary somewhat.

How is it then, that this operculum appears as if it consisted of triangular facets with intermediate parts which must fold in when closed? If we look at the closed operculum from above (Plate XXIV, fig. 14), we see a number of radiating lines meeting almost in the centre of the operculum, and other lines which run out from the same points in the periphery but which lie obliquely, all to the same side of the radial lines; the intermediate, narrow parts appear darker because there are here 3 layers of chitin. It is obvious that the radial lines have been taken to be the outer, the oblique lines the inner contours of the hypothetical, thin parts between the triangular facets. A section perpendicular to the middle of an edge will thus give the picture sketched in text-fig. 7 a. In reality the oblique lines are external and they are the same lines we see on the open operculum, whilst the radial lines are the contours of the inner lying parts of the segments of the operculum; there is no sharply marked fold in the chitin corresponding to this contour-line,

nor do we find any corresponding oblique line on the segments in the unfolded operculum; if we look at the closed operculum obliquely, so as to see along one of the edges, we find that this projects like a keel lying somewhat to the one side, and it will then be understood, how a section perpendicular to the middle of an edge gives the picture represented in text-fig. 7 b.

a

b.

Text-fig. 7.

How then has this operculum developed. — Probably the fact that the lower part of the opercular membrane is cylindrical, has led BROCH to the view, that the operculum here as in *Cuspidella* is formed of the uppermost part of the hydrothecal wall; this view is not correct. For *Calycella* LEVINSEN is right in thinking that the operculum is formed of the original roof of the hydrotheca. Plate XXIV, figs. 7—10 show some young hydrothecae, in the roof of which the radiating lines are visible, as described by LEVINSEN. Usually the roof is arched into the hydrotheca (figs. 7, 8); fig. 9 shows a hydrotheca in which the roof has been artificially squeezed out; fig. 10 shows a specimen from Iceland. When the hydranth is about to form its tentacles it retreats from the wall (just begun in fig. 7, further advanced in fig. 8) and from the roof, which thereafter does not undergo any change until the completed hydranth extends; then the central part of the roof is thrown off. The opercular membrane remaining is narrower above than below and will naturally split along the radiating lines. If the roof is high, dome-like and in its lower part cylindrical (figs. 7—9), the portion thrown off will be comparatively large, and the splits in the opercular membrane will be but short (figs. 11—13); if the roof is low (fig. 10) only a small part is thrown off and the splits in the opercular membrane will go further down. All the specimens examined from the Danmark Expedition have a high operculum. In all cases the "facets" of the operculum will become angular. The folding and closing of the operculum takes place in the above-described manner; and then all the corners of the facets lie uncovered and exposed to rubbing; this causes the rounded tongues we find in the older hydrothecae, which are always frayed at the rim (fig. 11).

I have seen all the developmental stages necessary to give this picture and I maintain:

In *Cuspidella* the operculum is formed of the uppermost

part of the hydrothecal wall; the whole of the distinctly marked roof is thrown off.

In *Calycella* the operculum is formed of the peripheral part of the hydrothecal roof; its central part is thrown off.

The opercula in *Cuspidella* and *Calycella* are thus not homologues and it is therefore quite unjustifiable to place them together under one genus.

Nor do I think it right to unite *Cuspidella* and *Campanulina.* The opercula in the two genera are certainly in the main of the same construction, only somewhat more regular in *Campanulina,* but there are two things which separate the two into naturally contrasted groups: 1) the form of the hydrotheca, 2) the form of the gonotheca. In *Campanulina* the hydrotheca is a calycle on a twisted pedicel, whereas in *Cuspidella* it is tube-shaped and quite without pedicel. The gonotheca is certainly only known for one species of *Cuspidella,* it is formed quite like a hydrotheca, but is longer; it is just this resemblance which was the cause of this gonotheca not being found until a few years ago, and the same fact makes it to a high degree probable, that the gonothecae in the other species of *Cuspidella* have a similar form and have thus been overlooked hitherto.

In *Campanulina,* as is known, the gonotheca has quite a different form. I think, therefore, that there is every reason, to keep *Cuspidella* as an independent genus.

On the other hand, I agree with Broch in placing *Opercularella* under *Campanulina*; its trophosome is of the same structure, but *Opercularella* has sessile gonophores, whilst *Campanulina* produces free medusae.

Lafoëina. — The hydrotheca is formed quite as in *Cuspidella,* but the possession of nematophores shows, as Broch rightly remarks, that *Lafoëina* must occupy a higher position within this family.

Tetrapoma and *Lovenella.* — As above hinted, the operculum in these genera, according to Broch, is also formed of the upper part of the hydrothecal wall; the free valves of the operculum would then correspond to the triangular facets, and the thinner parts should not only split but be completely thrown off, so that the facets become free: "Die Entwickelung des Opercularapparates ist bei der *Lovenella* [to which Broch ascribes *Tetrapoma* Lev.] etwas weiter geschritten. Hier haben sich die dickeren Teile des *Campanulina*-Deckels voneinander gänzlich getrennt und sind and den Hydrotheken scharf abgesetzt - - -". Quite apart from what is unreasonable in this view, I am able to produce positive evidence that the operculum in *Tetrapoma* is formed from the original roof of the hydrotheca;

this roof is divided into four free valves by two lines which cross one another, just as is described by LEVINSEN; in the Danmark Expedition's material of *Tetrapoma quadridentatum* (Hincks) I have been so fortunate as to find a young hydrotheca, in the roof of which the two intercrossing lines are visible, corresponding to the four free valves in the still unopened operculum (Plate XXIV, fig. 15).

It will have been seen from the above, that there is great diversity in the construction of the operculum in this family.

Synopsis of the northern genera of the family Campanulinidae.

1x	The operculum is formed of the upper part of the side-wall of the hydrotheca and appears, when opened, as a direct continuation of this	2
2x	The operculum consist of two longitudinally folded membranes, which are marked off from the remaining part of the hydrotheca by two curves and which on closing run together in a line like a roof	Stegopoma LEV.
2xx	The operculum has the form of a many-sided pyramid......................................	3
3x	Hydrotheca with distinct, twisted pedicel. Gonotheca urceolate or ovate	Campanulina v. BENED.
3xx	Hydrotheca tubular without definite pedicel. Gonotheca (where known) of the same form as the hydrotheca	4
4x	Without nematophores	Cuspidella HINCKS.
4xx	With nematophores..........................	Lafoëina SARS.
1xx	The operculum is formed of the original roof of the hydrotheca, marked off from the calycle by a sharp edge	5
5x	Only the peripheral part of the roof enters into the formation of the operculum. The closing occurs in the main by folding.......	Calycella (HINCKS) LEV.
5xx	The operculum is formed of the whole roof and consists of free valves	6
6x	The operculum consists of four valves......	Tetrapoma LEV.
6xx	The operculum consists of more than four valves..	Lovenella HINCKS.

Genus *Stegopoma* Levinsen.

Stegopoma fastigiatum (Alder) Levinsen.

Campanularia fastigiata	Alder	1860 [3]	p. 73.	Pl. V, fig. 1.
Calycella „	Hincks	1868 [28]	„ 208.	Pl. 39, fig. 3.
Stegopoma fastigiatum	Levinsen	1892 [38]	„ 176 & 180.	Tab. VI, Fig. 8.
„ „	Jäderholm	1909 [35]	„ 78,	Taf. VIII, Fig. 1.

Two hydrothecae on the cirri of *Hathrometra* (*Antedon*) *prolixa* (Sladen). The roof-shaped operculum is formed from the upper part of the hydrothecal wall.

Hab.: St. 99.

Depth: 300 m.

Geographical distribution: Arctic: Greenland, Northern Norway, Murman Sea. — British Isles, Bay of Biscay, Morocco.

Not earlier known from East Greenland.

Genus *Cuspidella* Hincks.

Cuspidella procumbens n. sp.

Plate XXIV, figs. 2—6.

Trophosome: The hydrothecae, which are several times longer than broad, everywhere of the same breadth, on an average 136 μ, spring from a filiform, smooth or irregularly wrinkled, creeping, branched stolon ca. 55 μ thick. The height of the operculum is almost as great as the diameter of the hydrotheca; there are 10—14 (on an average 11.9) facets in the operculum. The proximal part, usually the half, of the hydrotheca sticks to the support; the distal part bends upwards so that the upper part is quite or almost quite vertical (Pl. XXIV, fig. 2), just as in *Lafoëa serpens.* The proportion between the free and the attached part is very variable, especially when the support of the colony is irregular. Regarding the structure and development of the operculum see p. 379—380 and Pl. XXIV, figs. 3—6. — Owing to the bad state of preservation I can say nothing with regard to the structure of the hydranths.

Gonosomes: It has not been possible for me to discriminate these.

Very abundant at several stations, chiefly on hydroids and Bryozoans, yet not rarely on *Delesseria,* — Regarding the relation of this species to *Lafoëa serpens,* see p. 374.

Hab.: St. 21, 63, 68 a, 69, 71 a, 72 c, 99.

Depth: 6—60 m. and at 300 m.

Genus *Calycella* Hincks (Levinsen modif.).

Calycella syringa (Linné) Hincks.

Plate XXIV, figs. 7—14,

Sertularia	syringa	Linné	[40].		
„	volubilis	Pallas	1766 [47]	p. 122.	
„	repens	Ell. & Sol.	1786 [21]	„ 52.	
Campanularia	syringa	Lamarck	1836 [36]	„ 132.	
„	„	Johnston	1838 [31]	„ 155.	Textfig. 18.
„	„	„	1847 [32]	„ 110.	Textfig. 19.
Calycella	„	Hincks	1868 [28]	„ 206.	Pl. 39, fig. 2.
„	„	Levinsen	1892 [37]	„ 15.	Tab. I, Fig. 16—17.

Calycella	syringa	Levinsen	1892 [38]	p. 175 & 180.
„	„	Markt.-Turn.	1895 [43]	„ 411.
Campanulina	„	Bonnevie	1899 [13]	„ 74.
Calycella	„	Schydlowsky	1901 [52]	„ 146.
„	„	Jäderholm	1909 [35]	„ 80.
Campanulina	„	Broch	1909 [17]	„ 164 & 213. Textfig. 22.

This widely distributed species is very common at several of the stations of the Danmark Expedition, especially in quantities on *Delesseria* together with *Campanularia integra*; nor is it seldom on hydroids etc. Curiously enough it is absent from the rich station 68 a, though *Delesseria* is present at this station; it should be remarked that *Campanularia integra* is rare at St. 68 a. The specimens from St. 99 (depth 300 m.) are attached to the cirri of *Hathrometra* (*Antedon*) *prolixa* (Sladen).

Renovation up to 4 times. The stalks may be very long; I have seen a pedicel with even more than 20 windings; this applies especially to the stations 66 and 72 c.

The operculum is formed from the peripheral part of the original hydrothecal roof (see p. 380—381 and Pl. XXVI, figs. 7—14).

Gonosomes of very frequent occurrence.

Hab.: St. 21, 63, 66, 69, 71 a, 72 c, 95 a, X, 99.

Depth: 6—300 m., most abundant at 20—40 m., seldom at greater depths.

Geographical distribution: Arctic: circumpolar. — The coasts of Europe and North America, Red Sea, Yellow Sea, Hawaii. — Subantarctic: Burdwood Bank.

Not earlier known from East Greenland.

Genus *Tetrapoma* Levinsen.

Tetrapoma quadridentatum (Hincks) Levinsen.

Plate XXIV, fig. 15.

Calycella	quadridentatum	Hincks	1874 [29]	p. 149. Pl. VIII, figs. 17—20.
„	„	Thompson	1884 [56]	„ 7. Pl. I, fig. 20.
Tetrapoma	„	Levinsen	1892 [38]	„ 175 & 180.
„	„	Schydlowsky	1901 [52]	„ 146.
Lovenella	quadridentata	Broch	1909 [17]	„ 166 & 214. Textfig. 24.

A number of hydrothecae of this purely arctic species were found on *Sertularella tricuspidata* from St. 71 a.

Renovation twice. The operculum is formed from the whole of the original hydrothecal roof, which is divided into four free valves

by two lines crossing each other at right angles (see p. 382—383 and Pl. XXIV, fig. 15).

Hab.: St. 71 a.

Depth: 30—40 m.

Geographical distribution: Arctic: Greenland, Spitzbergen, Murman Sea, White Sea, Siberian Polar Sea.

Not earlier known from East Greenland.

Genus *Lafoëina* G. O. Sars.

Lafoëina maxima Levinsen.

Cuspidella grandis	Winther	1879 [58]	p. 275.	
Lafoëina maxima	Levinsen	1892 [38]	„ 175 & 182.	Tab. VI, Fig. 9—12.
„ „	Broch	1909 [17]	„ 165 & 213.	Textfig. 23, Tab. III, fig. 7.

A number of colonies of this purely arctic species were found at 3 stations; the largest colony (St. X) is 9 cm. high.

The operculum is formed from the uppermost part of the hydrothecal wall (see p. 382).

Hab.: St. 71 a, 95 a, X.

Depth.: 30—ca. 100 m.

Geographical distribution: Arctic: arctic America; Greenland, Spitzbergen, Iceland, Northern Norway, Murman Sea, north coasts of Europe and Asia, as far as the New Siberian Islands.

Fam. **Sertularidae.**

Genus *Sertularella* Gray (Levinsen modif.)

Sertularella tricuspidata (Alder) Hincks.

Plate XX, figs. 5—7.

Sertularia tricuspidata	Alder	1856 [1]	p. 111.	Pl. IV, figs. 1, 2.
Sertularella „	Hincks	1868 [28]	„ 239.	Pl. 47, fig. 1.
„ „	Thompson	1887 [57]	„ 394.	Pl. 14, fig. 3.
„ „	Markt.-Turn.	1895 [43]	„ 425.	Taf. 11, Fig. 4, Taf. 13, Fig. 9.
„ „	Schydlowsky	1901 [52]	„ 201.	
„ „	Nutting	1904 [46]	„ 100.	Pl. XXV, fig. 3-7.
„ „	Broch	1909 [17]	„ 168 & 214.	Textfig. 25.

A large quantity of well-developed colonies of this species, which is common in all arctic seas, is present from St. 71 a, as also some few, small colonies from St. 95 a.

On some colonies, almost all the hydrothecae show renovation, often 5—6 times, even up to 10 times, so that 11 hydrothecal rims in all can be counted; these rims always lie close to one another. —

The branches of the large, densely branched colonies are often connected by means of "tendrils" (see p. 357 and Pl. XX, figs. 5—7).

Gonosomes of frequent occurrence.

Hab.: St. 71 a, 95 a.

Depth: 30—ca. 100 m.

Geographical distribution: Arctic: circumpolar. — Atlantic coasts of Europe and North America, California, Japan. — Subantarctic: Burdwood Bank.

Sertularella gigantea Mereschkowsky.

Plate XXV, fig. 1.

S. polyzonias var. gigantea	Hincks	1874 [29] p. 151. Pl. VII, figs. 11, 12.
„ gigantea	Mereschk.	1878 [44] „ 330. Pl. XIV, figs. 6, 7.
„ quadricornuta	Hincks	1880 [30] „ 277. Pl. XV, figs. 1, 1 a.
„ gigantea	Thompson	1884 [56] „ 5. Pl. I, figs. 4, 5, 6, 8.
„ „	„	1887 [57] p. 393.
„ „	Hartlaub	1901 [24] „ 90. Textfig. 56.
„ „	Schydlowsky	1901 [52] p. 197. Tab. I, fig. 2. Tab. III, fig. 31.
„ „	Nutting	1904 [46] p. 87. Pl. XIX, fig. 7.
„ „	Jäderholm	1909 [35] „ 101.
„ polyzonias, forma gigantea	Broch	1909 [17] „ 170 & 215. Textfig. 26.

A few sterile colonies up to ca. 4 cm. high.

Most authors figure this species with smooth hydrothecae and say nothing about ringed furrows on them. In Mereschkowsky's original description (44) however, it is stated: "frequently we observe three or four undulations (ribs) crossing the hydrothecae". In the Danmark Expedition's specimens all the hydrothecae to hand are provided with 5—8 (most frequently 6) close, not deep but distinct, ringed furrows, which run right round the calycle, though they are most distinct on the external side. As division by rings is a character which varies greatly in all hydroids, and as in all other respects my specimens agree with the descriptions of *Sertularella gigantea* Mereschkowsky, I do not hesitate to refer them to this species.

Gonothecae are not present.

Some authors are of the opinion, that *S. gigantea* Mereschk. is only a variety of *S. polyzonias* (Linné), whilst most regard it as an independent species. No one has yet found transitional forms; until these are found, it seems to me most correct to keep *S. gigantea* as an independent species.

Hab.: St. 95 a, 96.

Depth: ca. 50—180 m.

Geographical distribution: Arctic: Greenland, Spitzbergen, north coast of Europe and Asia. — Kamschatka, Korea. — Antarctic.

Not earlier known from East Greenland.

Genus *Thujaria* Fleming (Levinsen modif.)

Thujaria laxa Allman.

Allman 1874 [7] p. 472. Pl. LXV, figs. 1, 1 a.
Broch 1909 [17] „ 175 & 221. Textfig. 31.

Three colonies, two of which are still penniform, 3 cm. and 8 cm. high; the third is full-grown, twisted; height 14 cm.

It is remarkable that the genus *Thujaria*, which is mainly arctic, is so sparsely represented in this material.

Hab.: St. 96.

Depth: 160—180 m.

Geographical distribution: Arctic: Greenland, Spitzbergen, Iceland, Norwegian Sea, north coast of Europe to Nova Zembla. — Atlantic coasts of Northern Europe.

Not earlier known from East Greenland.

Tribus *Thecaphora proboscoidea* Broch 1909.

Fam. **Campanularidae.**

Genus *Campanularia* Lamarck (Levinsen modif.).

Campanularia integra Mac Gillivray.

Campanularia	integra	Mac Gillivray	1842 [42]	p. 465.	
„	„	Johnston	1847 [32]	„ 109.	Pl. XXVIII, Fig. 2.
„	caliculata	Hincks	1853 [27]	„ 178.	Pl. V, B.
„	integra	„	1868 [28]	„ 163.	Pl. 31, fig. 1.
„	caliculata	„	„ „	„ 164.	Pl. 31, fig. 2.
„	„	Winther	1879 [58]	„ 273.	
„	integra	Levinsen	1892 [37]	„ 21.	Tab. I, Fig. 13—14.
„	„	„	1892 [38]	„ 168.	Tab. V, Fig. 14—18.

Campanularia integra	Markt.-Turn.	1895 [43]	p. 406.	Taf. 11, Fig. 7 u. 8.
„ „	Schydlowsky	1901 [52]	„ 126.	
Clytia caliculata	Nutting	1901 [45]	„ 170.	Pl. XVII, figs. 1, 2.
Campanularia Ritteri	„	„ „	„ 171.	Pl. XVII, fig. 5.
„ integra	Sæmundsson	1902 [54]	„ 55.	Tab. I, Fig. 1—2.
„ „	Jäderholm	1909 [35]	„ 65.	Taf. VI, Fig. 4—9.
„ „	Broch	1909 [17]	„ 185 & 225.	Textfig. 38 a, 40.

In great abundance at several stations, forming large, dense growths, especially on *Delesseria*, more rarely on hydroids.

The specimens are almost exclusively the thin-walled form (*forma typica*), with both bell-shaped and funnel-shaped hydrothecae. Between a number of thin-walled hydrothecae on a leaf of *Delesseria* (St. 66) one hydrotheca was found with the form typical of *forma calyculata* as also one hydrotheca which showed a transition point. The stalks of the hydrothecae are usually but slightly twisted above and below; but not rarely the pedicels are strongly twisted in the whole of their length, most frequently at St. 66. As a rule the pedicel is many times longer than the hydrotheca, but I have also seen pedicels which were only $1^1/_2$ times as long as the hydrotheca. I have seen 8 examples of abnormal hydrothecal renovation, a complete hydrotheca on a short (sometimes very short) stalk free inside another hydrotheca (fig. in Levinsen (37)); 7 of these examples are from St. 66. A figure similar to Levinsen's is given by Mereschkowsky (44); he regards the condition as an example of incomplete division, which points to the condition in the athecate hydroids, which according to M. are articulate or metamerous; the incomplete division is said to have been discovered by Agassiz (Contributions to the Nat. Hist. of U. S., IV). —

Renovation up to 3 times.

Gonosomes of very frequent occurrence.

Hab.: St. 21, 36, 63, 66, 68 a, 69, 71 a, 72 b, 72 c, 95 a, X, 96.

Depth: 6—180 m., most frequent at 20—40 m.

Geographical distribution: Arctic: circumpolar. — Cosmopolitan.

Not earlier known from East Greenland.

Campanularia volubilis (Linné) Alder.

Sertularia volubilis	Linné	[40].			
„ uniflora	Pallas	1766 [47]	p. 121.		
Campanularia volubilis	Alder	1856 [1]	„ 125.	Pl. IV, fig. 7.	

Campanularia	volubilis	Hincks	1868 [28]	p. 160.	Pl. 24, fig. 2.
„	„	Markt.-Turn.	1895 [43]	„ 405.	Taf. 11, Fig. 11.
„	reduplicata	Nutting	1901 [45]	„ 172.	Pl. XVIII, fig. 1.
„	volubilis	Jäderholm	1909 [35]	„ 67.	Taf. VI, Fig. 14.
„	„	Broch	1909 [17]	„ 184 & 224.	Textfig. 39.

This species, which is elsewhere very common in arctic regions, occurs rather sparingly here; on various hydroids.

Hab.: St. 64 a, 71 a, 95 a.

Depth: 30—ca. 100 m., most common at 30—40 m.

Geographical distribution: Arctic: circumpolar. — West coasts of Europe, North Sea, Mediterranean; North America, Atlantic and Pacific.

Not earlier known from East Greenland.

Campanularia groenlandica Levinsen.

Levinsen	1892 [38]	p. 168.	Tab. V, Fig. 10—12.
Schydlowsky	1901 [52]	„ 129.	
Broch	1906 [16]	„ 31.	Textfig. 1.
Jäderholm	1908 [34]	„ 10.	Pl. III, Fig. 7.
„	1909 [35]	„ 67.	Taf. VI, Fig. 12—13.
Broch	1909 [17]	„ 187 & 226.	Textfig. 41.

Some colonies of this arctic species are present on *Grammaria abietina* and *Sertularella gigantea* from St. 96.

The number of teeth is given by Levinsen as ca. 14, by Broch as 10—15, distributed in the following manner:

10	11	12	13	14	15	teeth
8	8	8	13	4	2	specimens, in all 43.

Average 12.07.

In 13 specimens from the Danmark Expedition I have found the following:

$$\left.\begin{array}{lll} 9 & 10 & \text{teeth} \\ 9 & 4 & \text{specimens} \end{array}\right\} \text{Average } 9.31.$$

I have measured the length of the hydrotheca and the diameter of the aperture in 15 specimens, with the following result:

$$\left.\begin{array}{l} \text{L. Average length: } 834\,\mu \\ \text{A. Average diameter: } 526\,\mu \end{array}\right\} \frac{A}{L} = \frac{526}{834} = 0.63 = \text{ca. } \frac{2}{3}.$$

Hab.: St. 96.

Depth: 160—180 meters.

Geographical distribution: Arctic: circumpolar.

Campanularia sp.

Plate XXV, figs. 2—5.

Long thin pedicels — ca. 2—5 mm. — rise from a creeping, filiform stolon; they have some distinct rings below, above or (especially on shorter pedicels) in the most of the length, twisted or irregularly ringed; a well-marked ring under the hydrotheca. The hydrotheca bell-shaped, decreasing rather evenly from about the middle downwards. The space below the diaphragm small, with a fairly sharp edge below. The diaphragm is not specially thickened. The hydrothecal wall very thin and hyaline. 10—13 finely rounded, rather low teeth with just as finely rounded interspaces. $\frac{A}{L} = \frac{1}{2}$.

Hydranth with ca. 18 tentacles.

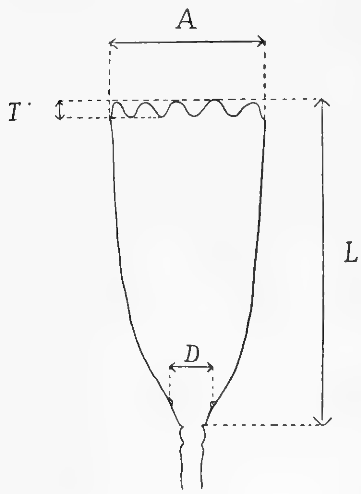
Gonosome: the gonotheca oblong ellipsoidal, borne on a short pedicel with 3 windings, with a short neck above; otherwise quite smooth.

I have not succeeded in finding any species in the literature, to which the above described *Campanularia* might be referred with certainty. I do not venture to set it up as a new species, however, as there are a few species which have some resemblance to it. It is perhaps identical with *C. turgida* Clark (1876 (49) p. 213. Pl. VIII, fig. 8) which according to the description has 12—16 rounded or truncated teeth; on the only hydrotheca figured $\frac{A}{L} = \frac{3}{5}$; the gonothecae of *Camp. turgida* quite agree with those described above; but both the description and the figures of *C. turgida* are insufficient as basis for an identification. It would be very desirable if authors would always send their new species out into the world with a clear and detailed description, good figures and accurate measurements, preferably of several dimensions.

In 1908 when taking part in a cruise onboard the Danish research-steamer "Thor", I collected some hydroids, which were later given to Mr. Sæmundsson of Reykjavik, Iceland, and they have been included in Sæmundssons paper, 1911 (55). The material contains, among other things, a *Campanularia*, which I could not identify; Sæmundsson refers it to *C. Johnstoni* (l. c. p. 78). Later, I have compared this material with the above-described *Campanularia* from the Danmark Expedition and found that it was undoubtedly of the same species. I found the following differences. The Icelandic specimens are slightly smaller, the pedicels of the hydrothecae have regular rings, at least above and below, often in the whole of their length: the teeth, 10—15, are a little higher — all characters which are very variable. The gonothecae are unfortunately not present in the Icelandic speci-

mens. In all other regards they agree with the Greenland specimens. —

C. Johnstoni has pointet teeth as a rule, but the teeth can be rounded (see Broch 1905 (15) p. 12); in the summer of 1910 I found *C. Johnstoni* with rounded teeth at Hellebæk in the northern part of the Sound; these specimens show the following differences from *Campanularia* sp. from Iceland and Greenland. The hydrothecae are considerably smaller, the teeth longer, the space below the diaphragm larger, rounded below, $\frac{A}{L} = \frac{3}{5}$, the hydrothecal wall thicker. The form of the gonothecae is sufficient to show that *Campanularia* sp., Greenland, is not identical with *C. Johnstoni*, but to make certain that the Icelandic *Campanularia*, which is sterile, is identical with the Greenland species, I have made measurements of quite a number of specimens, from Greenland, Iceland and Hellebæk. The results obtained show, that the Greenland and the Iceland specimens agree extremely well, whilst *C. Johnstoni* gives quite different figures.



Text-fig. 8.

The dimensions measured are as follows (see text-fig. 8).

L = Length of the hydrotheca.
A = Diameter of the aperture.
T = Height of the teeth.
D = Diameter of the diaphram.
N = Number of teeth.

All the lengths are expressed in μ and for each average number is given the average error, $\frac{\sigma}{\sqrt{n-1}}$, σ being the standard deviation, n the number of individuals.

These measurements show distinctly the differences mentioned above, especially when we consider the proportions between the different dimensions. There is no doubt, that *Campanularia* sp., Greenland, and *Campanularia* sp., Iceland, are the same species, and the proportions of the form in connection with the form of the gonothecae show that they are not identical with *C. Johnstoni*.

Occurs sparingly at 3 stations, on *Delesseria* and hydroids. 2 gonothecae have been seen (St. 71 a).

Hab.: St. 68 a, 69, 71 a.

Depth: 20—40 m.

Geographical distribution: N. E. Greenland, Iceland. Alaska (?).

	Campanularia sp. Grønl.	*Camp.* sp. Iceland	*C. Johnstoni*, Hellebæk
	Average $\frac{\sigma}{\sqrt{n-1}}$	Average $\frac{\sigma}{\sqrt{n-1}}$	Average $\frac{\sigma}{\sqrt{n-1}}$
L	883 ± 19	765 ± 18	613 ± 18
A	452 ± 10	380 ± 7	386 ± 10
T	48 ± 2	57 ± 2	72,8 ± 3
D	146 ± 3	136 ± 3	154 ± 5
N	11,47 ± 0,21	11,47 ± 0,22	11,23 ± 0,25

		Diff.		Diff.	
$\frac{A}{L}$	0,51	÷0,01	0,50	0,13	0,63
$\frac{T}{L}$	0,054	0,021	0,075	0,044	0,119
$\frac{D}{A}$	0,323	0,035	0,358	0,041	0,399
$\frac{D}{L}$	0,165	0,013	0,178	0,073	0,251

Campanularia verticillata (Linné) Lamarck.

Sertularia	verticillata	Linné	[40].	
„	„	Pallas	1766 [47]	p. 115.
Campanularia	„	Lamarck	1836 [36]	„ 131.
„	„	Johnston	1838 [31]	„ 156. Pl. XXII, Fig. 3, 4.
„	„	„	1847 [32]	„ 112. Pl. XXVI, Fig. 3, 4.
„	„	Hincks	1868 [28]	„ 167. Pl. 32, fig. 1.
„	„	Levinsen	1892 [38]	„ 166. Tab. V, Fig. 1—5.
„	„	Markt.-Turn.	1895 [43]	„ 405. Taf. 11, Fig. 15.
„	„	Jäderholm	1909 [35]	„ 69. Taf. VII, Fig. 4.
„	„	Broch	1909 [17]	„ 188 & 226. Textfig. 43.

From St. 71 a we have a large (ca. 5 cm.), branched colony and several smaller colonies of this species.

One of the colonies is attached to a Bryozoan; from a stolon creeping on the Bryozoan arise partly single, hydrotheca-bearing pedicels, partly an erect stem consisting of a single tube below, at once dividing and forming the compound stem characteristic of this species, with many hydrothecae arranged in indistinct circles.

Gonosome: One gonotheca found on the above mentioned colony.

Hab.: St. 71 a.

Depth: 30—40 m.

Geographical distribution: Arctic: circumpolar. — West coast of Europe as far as Bay of Biscay; North Sea, Kattegat; North America, Atlantic and Pacific. — Antarctic.

Not earlier known from East Greenland.

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Plate XX.

PLATE XX.

Fig. 1. Branch with "tendril" of *Lafoëa grandis*. × 12.

— 2. Branch with "tendrils" of *Lafoëa fruticosa*. × 12.

— 3. A "bridge" on an old colony of *Lafoëa fruticosa*. Tubes grow along the bridge from both sides, most numerous however from right to left. × 8.

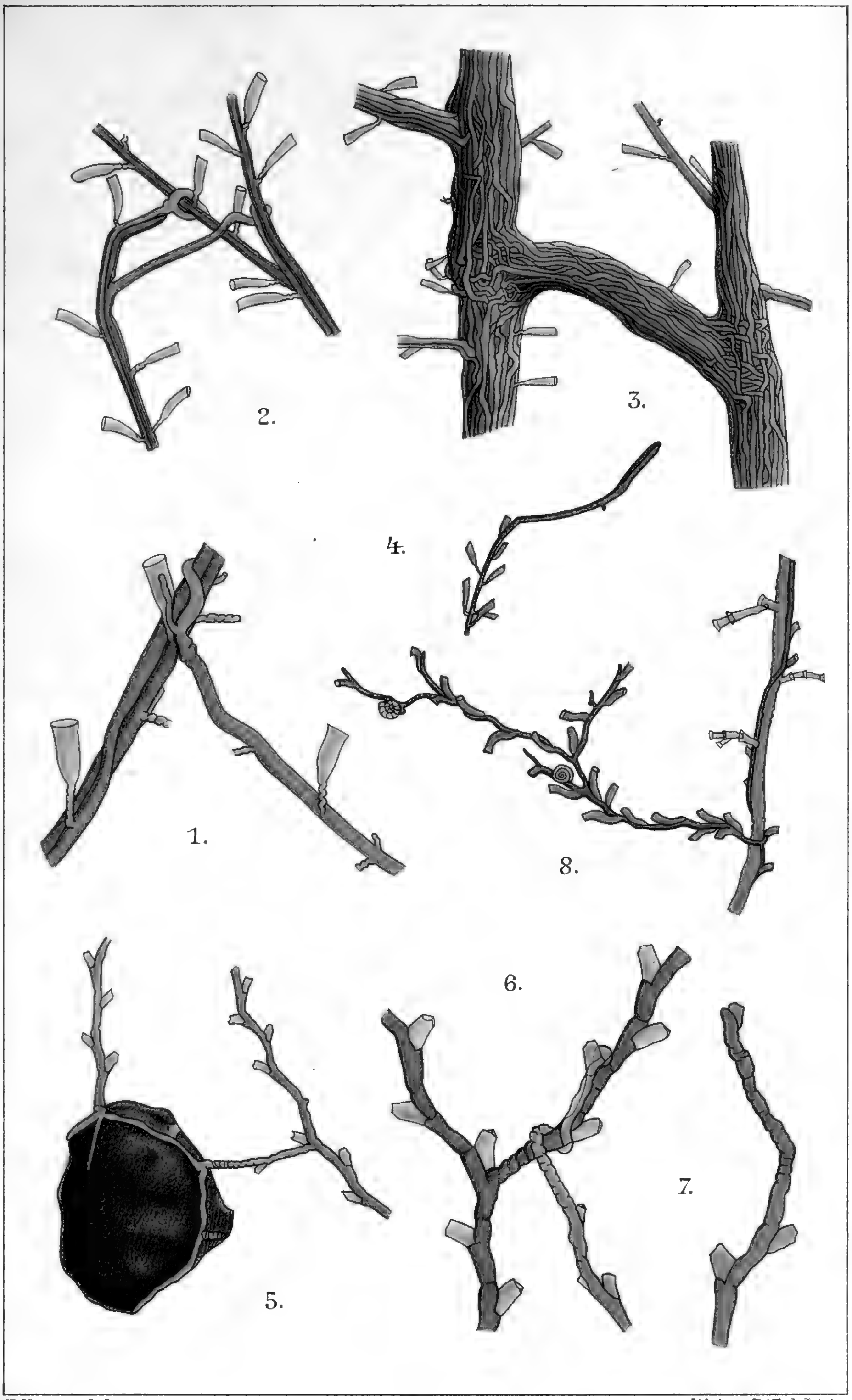
— 4. A "tendril" of *Toichopoma obliquum*. × 8.

— 5. A stolonized branch of *Sertularella tricuspidata* has fastened itself on a stone and formed stolons which have developed two new hydrocauli. × $5^1/_2$.

— 6. A stolonized branch of *S. tricuspidata* has fastened itself to and twined round another branch of the same colony. × 12.

— 7. A stolonized branch of *S. tricuspidata* which has begun to form hydrothecae again. × 12.

— 8. Erect branch of *Lafoëa serpens*. × 9.



P. Kramp del.

Lith. Anst. v. E. A. Funke, Leipzig

Plate XXI.

PLATE XXI.

Fig. 1. The end of a branch of *Halecium muricatum*, which has fastened itself on a shell and has formed stolons. × 12.

— 2. *Halecium labrosum*. From a hydrotheca grows, instead of a new hydrotheca, a long, wrinkled thread which has fastened itself to a shell and formed stolons. × 12.

— 3. A hydrotheca of *Halecium labrosum* with an unusually long pedicel. × 50.

— 4. A piece of a colony with three hydranths of *Halecium curvicaule*. × 18.

— 5. A piece of a colony of *Halecium textum* n. sp. × 18.

— 6. Two hydrothecae (a pseudohydrocaulus) of the same species, showing a. o. the pseudodiaphragm. × 75.

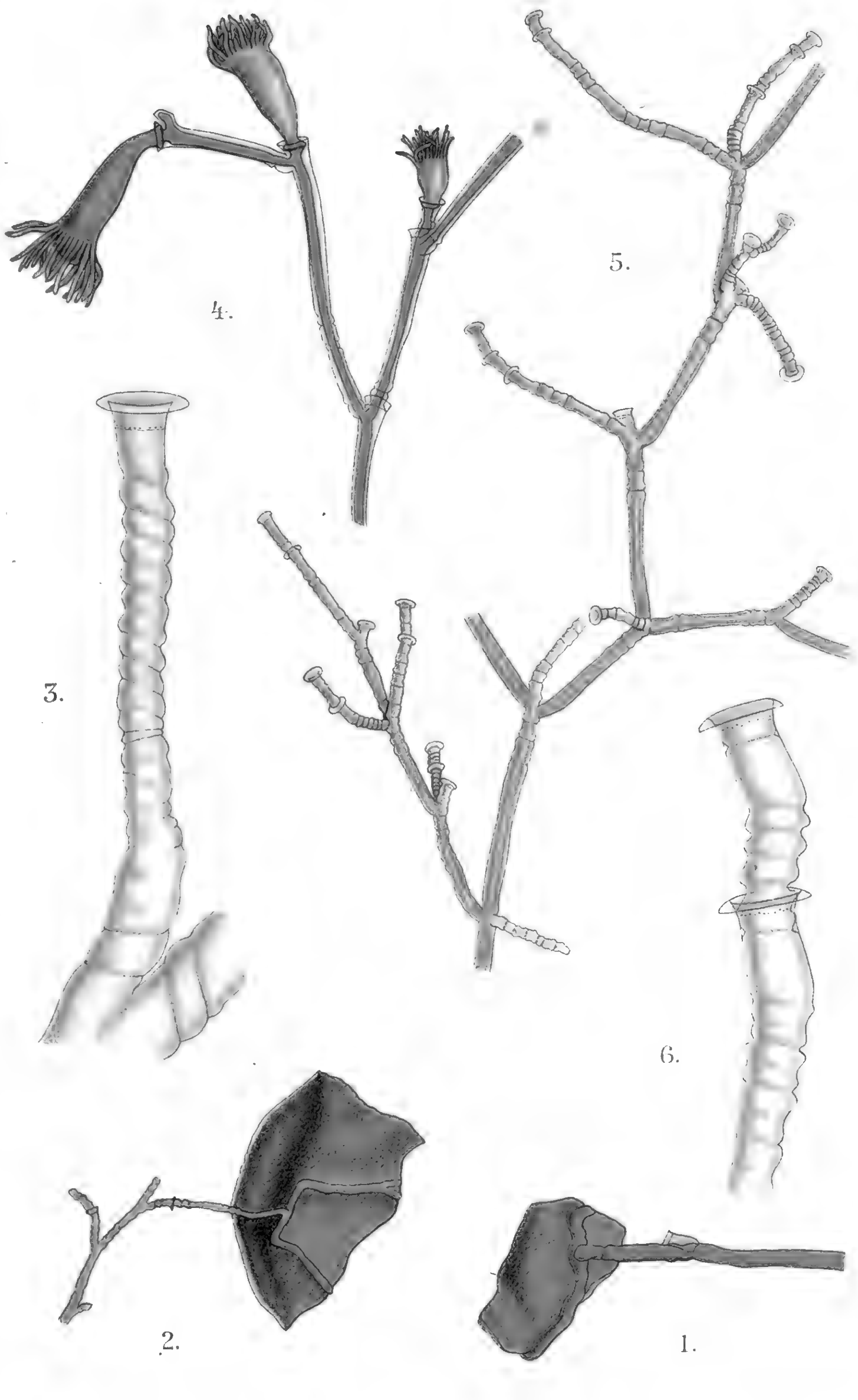


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Plate XXII.

PLATE XXII.

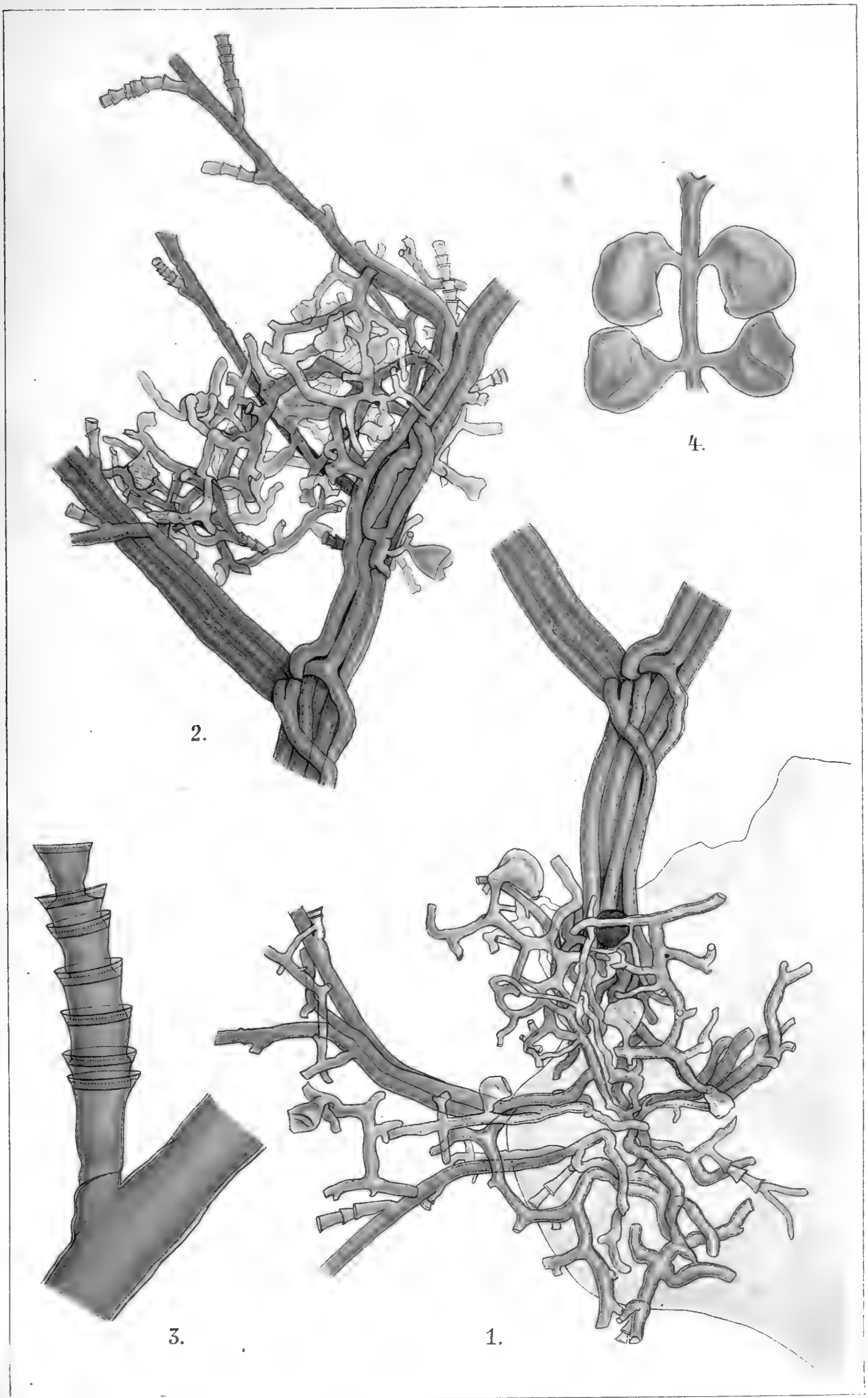
Halecium groenlandicum n. sp.

Fig. 1. The lower part of the colony with the characteristic rhizome, whose irregularly ramified tubes bear some hydrothecae and gonothecae. The colony is growing on a Bryozoan, which is only shadowed in the figure. × 11.

— 2. The middle part of the stem from which arise closely ramified tubes bearing hydrothecae and gonothecae. × 11.

— 3. A series of hydrothecae (a pseudohydrocaulus). × 40.

— 4. A small branch from the rhizome with four gonothecae. × 18.



P. Kramp del. Lith. Anst. v. E. A. Funke Leipzig

Plate XXIII.

PLATE XXIII.

Fig. 1. A hydrocaulus of *Halecium* sp. (*tenellum* Hincks aff.). × 18.
— 2. Two hydrothecae of the same species. × 50.
— 3. A colony of *Halecium* sp. (*minutum* Broch aff.). × 18.
— 4. A piece of the same colony. × 80.
— 5. Coppinia of *Toichopoma obliquum.* Natural size.
— 6. A piece of the same Coppinia. × 11.
— 7. A little part of the surface of the Coppinia with four hydrothecae, two of which are cut off just at the bottom. × 60.
— 8. One of the transformed hydrothecae from the Coppinia, with closed and with opened operculum. × 60.

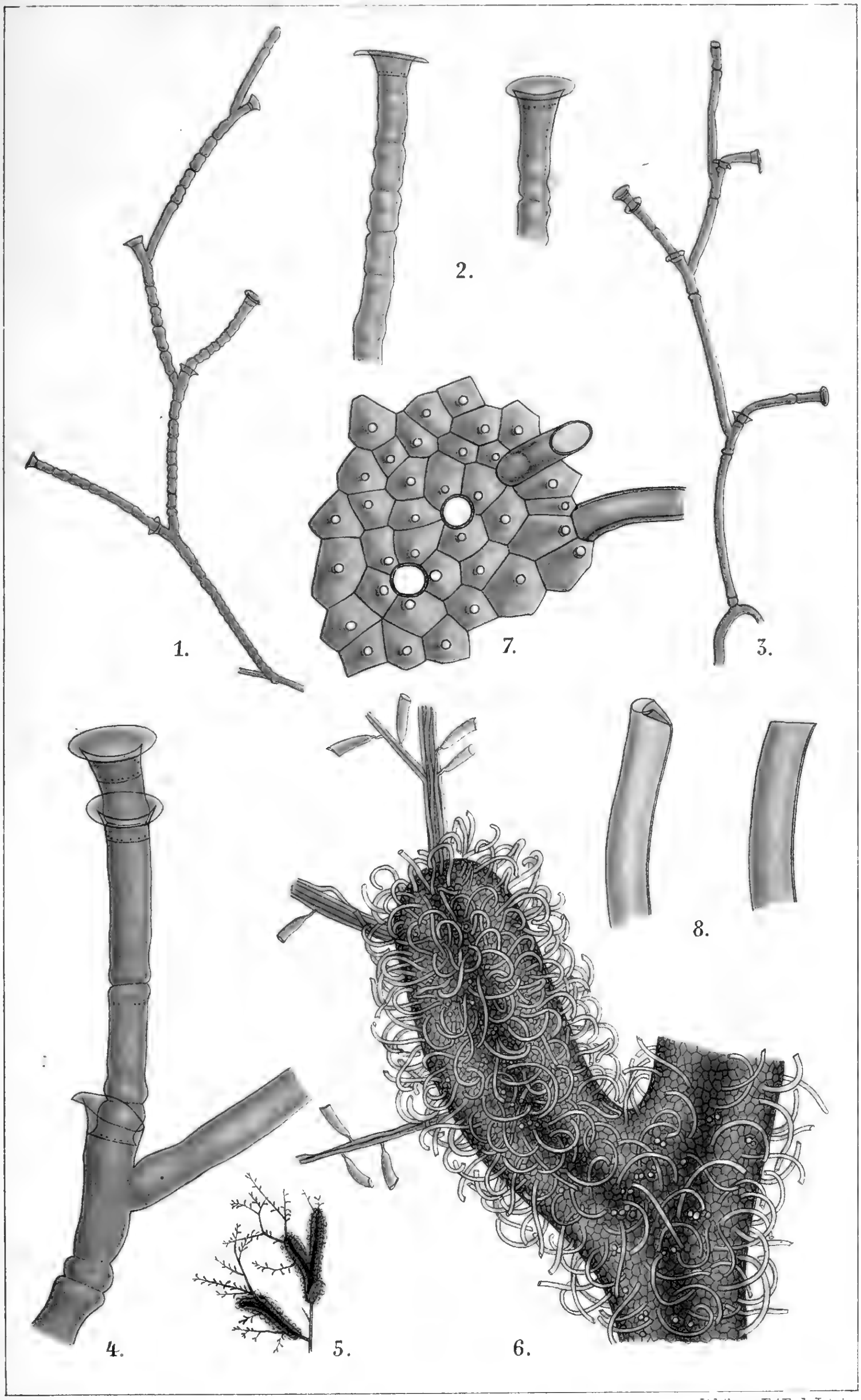


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Plate XXIV.

PLATE XXIV.

Fig. 1. *Toichopoma obliquum.*

Fig. 1. A young hydrotheca. The thin roof and the curve which bounds the later operculum are seen. × 50.

Figs. 2—6. *Cuspidella procumbens.*

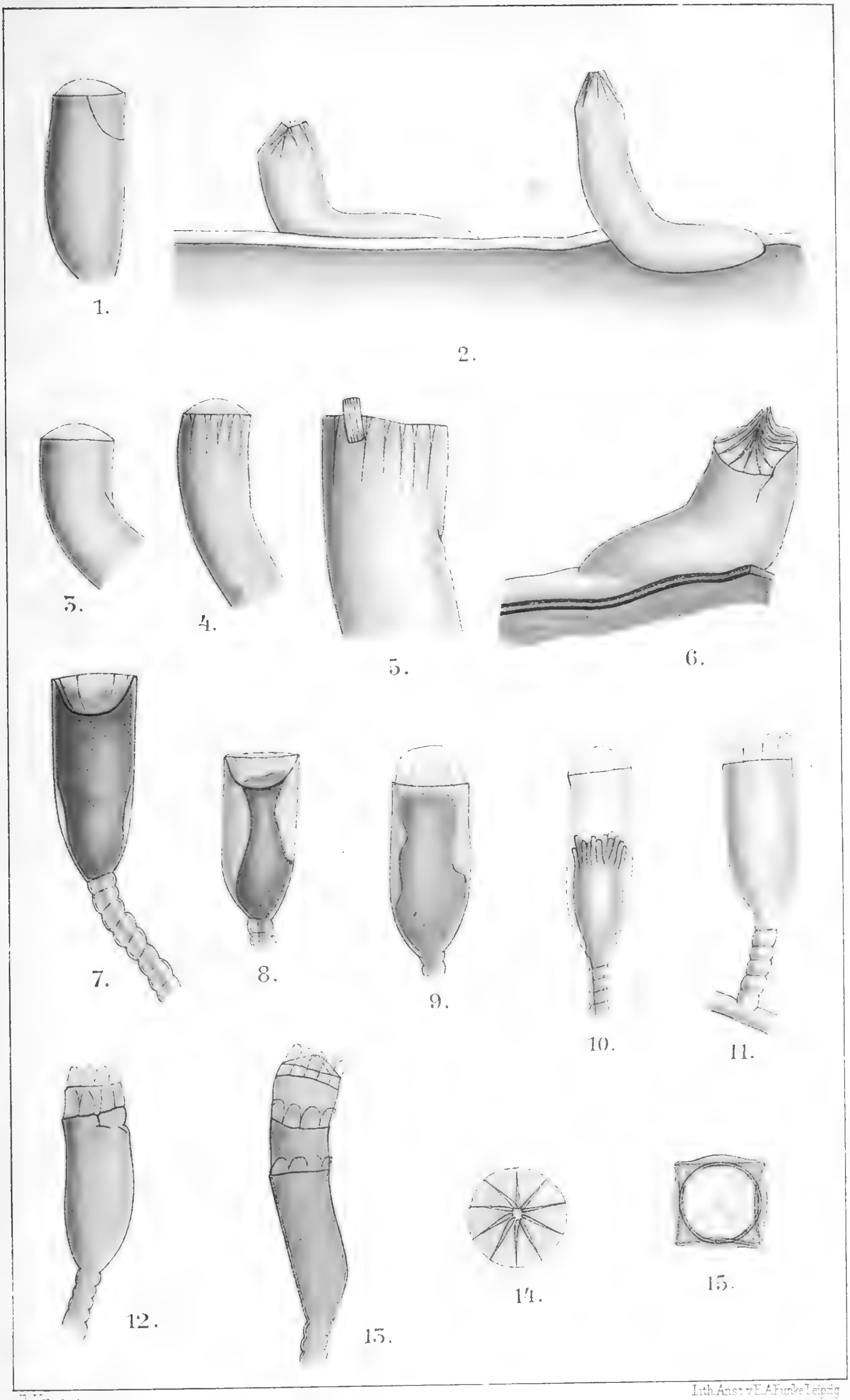
— 2. A piece of a stolon with two typical hydrothecae. × 50.
— 3. A young hydrotheca. × 50.
— 4. A somewhat more developed hydrotheca. The lines along which the operculum will fold later are shown. × 50.
— 5. A full-grown hydrotheca; the operculum opened. × 80.
— 6. A full-grown hydrotheca; the operculum is bounded from the remaining part of the hydrotheca by a sharp edge. × 80.

Figs. 7—14. *Calycella syringa.*

— 7. A young hydrotheca; the hydranth-bud nearly fills out the calycle. × 50.
— 8. A young hydrotheca; the hydranth-bud is withdrawing from the retracted roof, in which the radiating lines are seen. × 50.
— 9. do. The roof artificially turned out. × 50.
—10. A young hydrotheca with a low roof; from Iceland. × 50.
—11. A hydrotheca from N. E. Greenland, showing the tongues rounded by wear. × 50.
—12. A hydrotheca from Hellebæk, showing the angular tongues. × 50.
—13. do., renovated thrice; the youngest operculum closed, the preceding with angular tongues, the two oldest with worn tongues. × 50.
—14. A closed operculum seen nearly from the top; the two folds on the right are seen edgewise. × 80.

Fig. 15. *Tetrapoma quadridentatum.*

—15. A young hydrotheca seen from the top; the two crossing lines are seen, which bound the four valves in the not yet opened operculum. × 80.

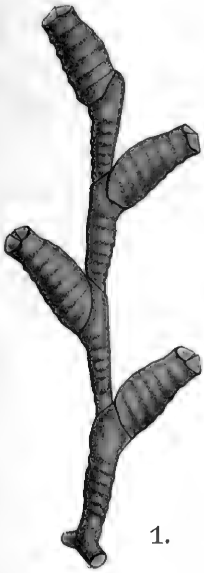


P. Kramp   Lith. Anst. v. E. A. Funke Leipzig

Plate XXV.

PLATE XXV.

Fig. 1. *Sertularella gigantea.* × 8.
— 2. A hydrotheca and a gonotheca of *Campanularia* sp. × 18.
— 3. A gonotheca of the same species. × 18.
— 4. A hydrotheca of *Campanularia* sp. from Greenland. × 50.
— 5. A hydrotheca of *Campanularia* sp. from Iceland. × 50.
— 6. *Garveia groenlandica.* × 50.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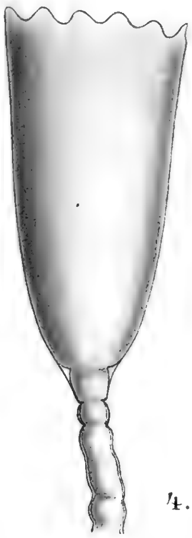
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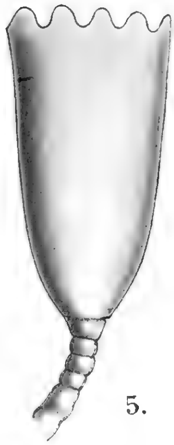
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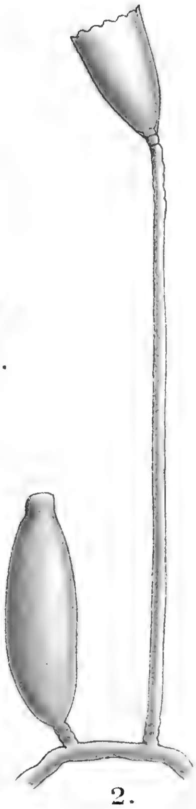
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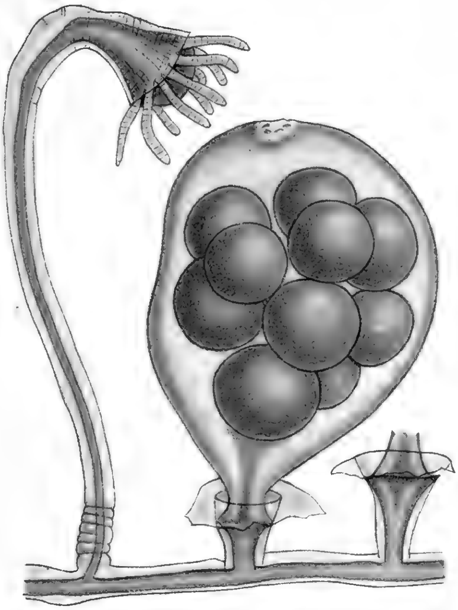
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P. Kramp del.

Lith. Anst. v. E. A. Funke, Leipzig

VIII.

A NEW SPECIES OF ENTOPROCTA, LOXOSOMELLA ANTEDONIS, FROM NORTH-EAST GREENLAND

BY

Dr. TH. MORTENSEN

1911

On examining the specimens of the Crinoid *Hathrometra* (*Antedon*) *prolixa* (Sladen) brought home by the Danmark-Expedition (from Station 99; 77° Lat. N. $17^1/_2$° Long. W., 300 m.; 22/VII 1908) I found attached to their cirri, besides a number of Hydroids a. o. small animals, several specimens of a species of *Loxosoma* (Cf. Report on the Echinoderms collected by the Danmark Expedition at North-East Greenland. Medd. om Grønland. XLV. 1910. p. 244). As was suggested in the place quoted it represents a new species, which I shall describe here under the name of

Loxosomella[1] **antedonis** n. sp.

The shape of the animal is seen from Pl. XXVI Figs. 1—5. The calyx is beautifully oval, without expansions on the sides; it passes very gradually into the stalk, which is simply cylindrical, slightly narrowing towards the base. The length of the stalk is somewhat variable, from a little shorter to a little longer than the length of the calyx (Figs. 2, 4). The total length of the animal is 0,5—1 mm. Generally the stalk is curved, the animal bending its atrial opening towards the cirrus to which it is attached. (Figs. 1, 5).

The number of the tentacles is 14 or 16; I have been unable to observe with certainty whether there are tentacles developed at the anterior border of the atrium, off the mouth opening; I think there is not, and then the normal number of tentacles will be 14.

The stalk does not contain any foot gland, while in the buds there is a distinct gland (Fig. 2). This gland after having secreted a finely granular substance, by which the animal fixes itself, atrophies completely so as to leave no trace at all in the grown specimens. (Fig. 9). In a few specimens I have observed a similar linear arrangement of nuclei in the stalk as that figured by Salensky in *Loxosoma crassicauda* (Études sur les Bryozoaires entoproctes. Ann. Sc. nat. 6. Sér. V. 1877 Zoologie. Pl. 13. Fig. 12). I do not, however,

[1] Regarding the name *Loxosomella* see below, p. 405.

see any reason to regard these cells as glandular, as is done by SALENSKY; probably they represent traces of an original arrangement of the cells in regular longitudinal rows, as described by NITSCHE in *Loxosoma Kefersteinii* Clap. (Über die Knospung der Bryozoen. Zeitschr. f. wiss. Zool. XXV. 1876. p. 142. Taf. XXV. Fig. 7) and by HARMER in *L. Tethyæ* Sal. (Structure and development of Loxosoma. Quart. Journ. Micr. Sc. N. Ser. XXV. 1885. Pl. XIX. Fig. 9). The cuticula of the stalk is irregularly ringed, probably the result of the contraction on preservation.

The musculature of the stalk is not very strongly developed, consisting only of longitudinal muscles, arranged in a single layer all round inside the epidermis. Oblique muscles, so conspicuous in the species *L. annelidicola* (v. Ben. & Hesse) and *L. Davenporti* Nickerson, are not developed. This slight development of the musculature is in fair accordance with the fact that the animal is fixed for life; the same condition is found in *L. crassicauda* Sal. which is likewise fixed for life by a secretion from the foot-gland present in the bud, but atrophying after the fixation of the animal, while both *L. annelidicola* and *L. Davenporti* remain free and are able to change their position.

The structure of the muscles is very peculiar. On sections of the stalk the muscle cells are seen to contain numerous fine fibres, arranged in a circle along the periphery (Fig. 7). So far as I am aware, such a structure of the muscles has not hitherto been observed in any species of *Loxosoma*. On the other hand a quite similar structure of the muscles has been described by DAVENPORT in *Urnatella gracilis* Leidy (Bull. Mus. Comp. Zool. XXIV. 1893. p. 5. Pl. II. Figs. 9—11, 16—17), and also in *Ascopodaria macropus* Ehlers a similar arrangement of the muscle fibres appears to exist, the musculature being, otherwise, much more developed in this form. (Cf. E. EHLERS. Zur Kenntnis der Pedicellineen. Abh. d. Ges. d. Wiss. Göttingen. XXXVI. 1890. p. 25. Taf. I. Fig. 12—14). It may then not be unreasonable to suggest, that the same structure of the muscles will prove to occur also in other forms — if not in all — of the Entoprocta.

On each side of the calyx, about at the level of the mouth opening, are found 1—3 large glandular cells (Fig. 8); the plasma is finely granular, and a rather large nucleus lies at the bottom of the cell. Together with these glandular cells is found a small papilla of a peculiar structure, one on each side of the body (Figs. 2—4, 6). In the interior of the papilla is seen a large nucleus and outside this the plasma appears to be compact and dark, while in the rest of the organ it is quite hyaline. — These papillæ are doubtless the

homologues of the sense organs found in a corresponding place in some other species of *Loxosoma*, viz. *L. crassicauda* and *phascolosomatum*. (Cf. C. Vogt. Sur le Loxosoma des Phascolosomes. Arch. Zool. expér. & génér. V. 1876. p. 312—13, Pl. XI. Fig. 3, Pl. XII. Fig. 1; Salensky. Op. cit. p. 12. Pl. 12. Figs. 2—4; Harmer. Op. cit. p. 273. Pl. XIX. Fig. 1). It is true, I have not been able to observe the tactile hairs on the papillæ; but this must be due to the preservation. The darker spot seen outside the nucleus I suppose to represent the invaginated outer part of the papilla, so that the hairs should lie within the invaginated part; if this be the right explanation, one cannot wonder that the hairs are not to be seen; moreover, I think I have seen indications of them in one case. Also in *L. annelidicola* similar sense organs appear to exist (Cf. Prouho: Étude sur le Loxosoma annelidicola. Arch. zool. expér. & génér. 2. Sér. IX. 1891. p. 99. Pl. V. Fig. 3), while the "flask organs" of *L. Davenporti* are regarded as not homologous to the sense organs of the other species. (Cf. Nickerson: On Loxosoma Davenporti. Journ. of Morphology. XVII. 1901. p. 357. Pl. XXXII. Fig. 11, Pl. XXXIII. Figs. 16—19).

The inner anatomy of the animal is, so far as I have been able to see, in its main features in accordance with the ordinary type of this genus. The alimentary canal does not present more prominent special characters; the anal tube is not free. The nervous system and excretory organs I have not been able to trace with certainty. The ovaries are seen in the specimen reproduced in Fig. 4. In a specimen sectioned I find the testes well developed. The species is accordingly not bisexual—or, at least, both sexes are not developed contemporaneously. It may be worth noticing in this connection that buds were present on the male specimen. The genital ducts have not been observed. In one of the specimens sectioned an embryo lies within the atrial cavity. Any structure recalling the mammary organ of *L. Davenporti* does not exist.

Fig. 1. Optical section through the foot of a bud, showing the foot-gland. $^{385}/_{1}$.

The buds arise alternating, one on each side (Figs. 2, 3). As stated above, there is a well developed foot-gland in the buds; it is somewhat widened at its upper end (Textfig. 1). This widening appears to be the homologue of the "corps pédieux" described by Vogt in *Loxosoma phascolosomatum* (Op. cit. p. 341. Pl. XIV. Figs. 8—16). Vogt does not seem to have observed that it

is the upper part of the foot-gland; he thinks it produces the connective tissue of the stalk and that it is the homologue of the peculiar umbilical cells of *L. Kefersteinii*, which form the attachment of the buds in that species. The fact that the buds of *L. phascolomatum* are attached by the end of the stalk does not lend support to Vogt's suggestion. I think, there can be no doubt that the "corps pédieux" of this species is really the widened upper end of the foot-gland as in *L. antedonis*, representing the secretory part of the gland, the lower part being the duct.

There seems to me no reason to enter on a detailed description of the development of the buds, partly because the preserved material is not sufficient for a detailed study of this development, partly because the facts observed indicate that the species does not show any more noteworthy differences herein from what has been made known for other species of *Loxosoma*. It should only be pointed out that the buds are attached with the end of the stalk as in most of the other species, but contrary to what obtains in *L. Kefersteinii*.

Whether the species is bound to the habitat on the cirri of the Crinoids I am unable to say; in any case it as yet not known to occur on any other host.

This species, which is the first *Loxosoma* observed on any Echinoderm, so far as I am aware, appears to be nearly related to *L. crassicauda* Salensky; especially it is noteworthy that the structure of the foot is the same. Of its specific difference from that species there can, on the other hand, be no doubt; as more prominent differences may be pointed out: the greater number of buds in *crassicauda* and the more numerous gland cells; also the shape of the foot-gland in the buds of *L. crassicauda* is different from that of *L. antedonis*. Another species showing affinities to the present species is *L. phascolomatum* Vogt, and probably the relation between the latter species and *L. antedonis* is more close than with *L. crassicauda*. The great length of the foot and its peculiar bisected extremity in *L. phascolomatum* are the more prominent differences between the two species, besides, of course, the very different habitat.

The species *Loxosoma claviforme* Hincks (British Marine Polyzoa. Pl. 81. Figs. 9—11) shows a considerable likeness to *L. antedonis* in general shape. Though it is quite insufficiently known it can, however, not be doubted that it has really nothing to do with the species here described. The peduncle is described as "terminating below in a short, foot-like expansion", which also appears from the figs. 9 a. and 11. This would indicate that it is related to such forms as *L. raja* Schmidt; Harmer (Op. cit. p. 263) identifies it

provisionally with *L. singulare* Kef., which seems not very probable, the foot of this latter species forming a round sucking disk. The habitat of *L. claviforme* (on *Hermione hystrix*, shallow water; Guernsey) does not indicate any nearer relation to *L. antedonis* either.

The three species named, *L. crassicauda*, *phascolosomatum* and *antedonis* would appear to form a separate group among the species referred to the genus *Loxosoma;* they agree in having special sense-organs, and especially in the important feature that a foot-gland is present only in the buds, atrophying after having secreted a substance through which the animal becomes fixed for life; the musculature is accordingly only feebly developed, consisting only of straight, longitudinal muscles. — The same is the case also in *L. Kefersteinii* Claparède; however, the peculiar fact that the buds are not attached by the base of the foot but by some umbilical cells, the foot developing transversally to the longitudinal axis of the bud, would appear to entitle this species to a separate position within the genus.

In connection herewith I would suggest that among the species referred to *Loxosoma* other groups may be distinguished. The two species *L. annelidicola* (v. Ben. & Hesse) and *Davenporti* Nickerson agree in the total lacking of the footgland, both in the grown species and in the buds; (the presence of special gland-cells in the foot disk is a different thing; they can scarcely be regarded as homologues of the foot-gland in the other species); the base of the foot is developed as a sucking disk, the musculature consisting of both straight and oblique fibres, and the animal is thus not fixed for life but can change its position. Also the shape of the body is alike, being more or less winglike expanded; this is, however, probably of minor importance, as it appears to be not constant in *L. Davenporti* and also in *L. raja* Schmidt, which is not more nearly related to these species, the body is similarly expanded. More importance might be ascribed to the structure of the excretory organs; according to Prouho and Nickerson these two species have the excretory organs built on quite a different plan from that described by Harmer for *L. crassicauda* (Op. cit. Pl. XX. Fig. 17); in the latter species it is an intracellular tubule terminated by a flame cell, while in *annelidicola* and *Davenporti* it is described as being composed of vacuolated cells, which are not pierced by an intracellular canal. The discrepancy between these two statements one might suppose to be due, not to erroneous observation on one or the other part, but to these species really having their excretory organs thus differently built. This, however, appears not to be the case. G. Stiasny (Beitrag zur Kenntnis des Exkretionsapparates der Entoprocta. Arb. Zool. Inst. Wien. XV. 1905. p. 183—194) has most

carefully reexamined the excretory organs of both *L. crassicauda* and *annelidicola* and found them in both forms to be intracellular tubules ending in a flame-cell. His suggestion that all the Entoprocta will prove to have their excretory organs built on this type seems quite justified. — In any case I would suggest that these two species are more nearly related to each other than to any of the other species referred to the genus *Loxosoma*, with the exception, probably, of *L. singulare* Keferst. (see below). NICKERSON certainly thinks that *L. Davenporti* resembles most closely *L. crassicauda*, mentioning among other characters in which they agree the absence of a foot-gland. (Op. cit. p. 373). This is, however, a mistake, *L. crassicauda* having the foot-gland well developed in the buds.

It is very probable that also *L. singulare* Keferstein belongs to this group. Claparède (Beobachtungen über Anatomie u. Entwicklungsgeschichte wirbelloser Thiere. 1863. p. 106) states that "die ganze Sohle mit zahlreichen . . . . rundlichen Zellenkernen besetzt ist, die unmittelbar unter der farblosen Cuticula sitzen", and that the basal part of the foot is developed as a sucking disk[1]. This makes it very probable that the structure of the foot is really as in *L. annelidicola* and *Davenporti;* but there are, unfortunately, no observations showing, whether oblique muscles are present or not, and it is not definitely shown either, whether a foot-gland is possibly developed in the buds.

Another natural group of species would appear to be formed by those in which the foot-gland persists through life, viz. *L. nepolitaum* Kowalevsky, *L. raja* Schmidt, *L. tethyæ* Salensky, *L. alata* Barrois (= *L. pes* Schmidt), *L. leptoclini* Harmer and *L. Harmeri* Schultz. Possibly this group should be further subdivided after the shape of the foot, it being more or less wingshaped widened in *L. raja*, *tethyæ leptoclini* and *alata*, while in *L. nepolitaum* and *Harmeri* it is not thus widened.

A few species are still left, viz. *L. cochlear* Schmidt, *L. claviforme* Hincks and *L. Nitschei* Vigelius. These are so insufficiently known that it is impossible to say to which group they belong[2].

I would think it not unreasonable to regard these different groups as separate genera. The first species described of the genus

[1] E. SCHULTZ. Loxosoma Harmeri. Travaux de la Soc. Imp. des Nat. St. Petersbourg, XXV. 1895 p. 55. states that *L. singulare* has a foot-gland; but this must be a mistake.

[2] In K. DERJUGIN. Zur Kenntniss der Fauna des Kola-Fjords. Die Arbeiten an Bord des Jacht „Alexander Kowalevsky", im Jahre 1909. (Vorl. Mitteilung) II. (Trav. Soc. Imp. Nat. St. Pétersbourg XLII. 1911. p. 23 and 43) are named *Loxosoma kowalevskii* Kl. n. sp. and *L. normanni* Kl. n. sp., without any description or figures. They are thus only nomina nuda.

Loxosoma being *L. singulare* Keferstein, this name ought then properly to be restricted to the group: *singulare, annelidicola, Davenporti;* the name *Cyclatella* van Beneden & Hesse becomes a synonym hereto, provided it does not ultimately prove that *L. annelidicola* is generically different from *L. singulare,* which does not seem probable. In any case the species *singulare* Keferst. remains the genotype of the genus *Loxosoma.*

For the two other groups new generic names must be created; I would suggest the name **Loxocalyx** for the group of species with the foot-gland persisting through life, taking the species *raja* Schmidt as the genotype. The species without winglike expansions of the foot may be left in this genus for the present. — For the group of species in which the foot-gland becomes atrophied after the fixation the name **Loxosomella** may be proposed, the species *crassicauda* Salensky being taken as the genotype.

These three genera form together a very natural family, **Loxosomatidæ,** the family having already been rightly established by Hincks (Op. cit. p. 571).

It may not be out of place to give a brief summary of the classification thus proposed of this little family.

Fam. **Loxosomatidæ** Hincks.

Solitary Entoprocta with a contractile peduncle; the body (calyx) compressed; the vestibule occupies an oblique position at the anterior, ventral side of the body. Buds developing from the sides of the body. The family includes the following genera:

Loxosoma Keferstein. (Syn. *Cyclatella* Van Ben. & Hesse). The foot is developed as a sucking disk, provided with straight and oblique muscles. No foot-gland, only single gland cells in the disk. The animal can change its position.

Genotype: *L. singulare* Keferstein. Other species: *L. annelidicola* (v. Ben. & Hesse), *L. Davenporti* Nickerson.

Loxocalyx n. g. The foot is provided with a foot-gland, persisting through life; only straight muscles developed. The animal can probably change its position. The foot (mostly) with winglike expansion.

Genotype: *L. raja* (Schmidt). Other species: *L. tethyæ* (Salensky), *L. alata* (Barrois), *L. leptoclini* (Harmer); possibly also: *L. neapolitanum* (Kowalevsky) and *L. Harmeri* (Schultz).

Loxosomella n. g. The foot-gland present only in the buds, atrophying in the grown animals after having secreted a fluid, by which the animal is fixed for life. Only straight muscles developed in the foot.

Genotype: *L. crassicauda* (Salensky). Other species: *L. phascolosomatum* (Vogt), *L. antedonis* Mrtsn. Possibly also: *L. Kefersteinii* (Claparède).

Incertæ sedis: *L. cochlear* Schmidt, *L. claviforme* Hincks, *L. Nitschei* Vigelius.

29—9—1911.

Plate XXVI.

PLATE XXVI.

All the figures relate to the species *Loxosomella antedonis* Mrtsn.

Fig. 1. Side view. $^{90}/_{1}$.

— 2. Front view of a short-stalked specimen with two buds; in the left bud is seen the foot-gland. $^{95}/_{1}$.

— 3. Dorsal view of a long-stalked specimen with two young buds; shows the secretion by which the foot is attached. $^{95}/_{1}$.

— 4. Front view of a specimen without buds; showing the ovaries. $^{95}/_{1}$.

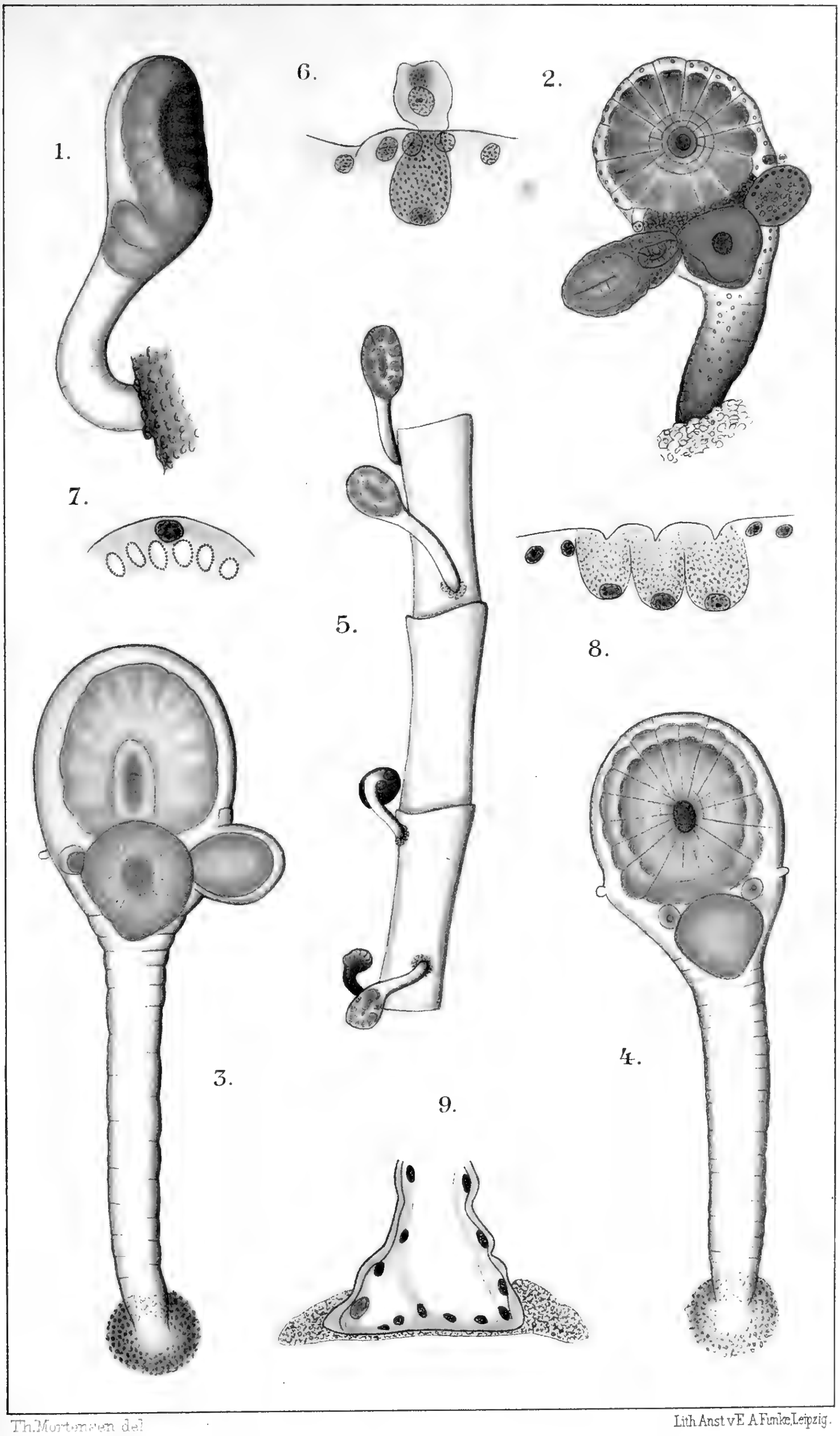
— 5. Some specimens in their natural position on a cirrus of *Hathrometra (Antedon) prolixa*. $^{25}/_{1}$.

— 6. Optical section through part of the side wall of the body, showing a gland-cell and a sense-organ. $^{530}/_{1}$.

— 7. Part of section through the stalk, showing the arrangement of the fibres within the muscle cells. $^{530}/_{1}$.

— 8. Optical section through part of the side wall of the body, showing three gland-cells. $^{385}/_{1}$.

— 9. Longitudinal section through the base of the foot, showing its attachment in the secretion. $^{280}/_{1}$.



Th. Mortensen del. Lith. Anst. v. E. A. Funke, Leipzig.

IX.

ANNELIDS FROM THE DANMARK EXPEDITION

BY

HJALMAR DITLEVSEN

1911

In all 43 species of polychaetous Annelids have been brought home by the Danmark Expedition. Of these the great majority consist of the ordinary arctic, coastal forms and give the well-known picture of the fauna, which is claracterized chiefly by such species as *Harmothoe imbricata and nodosa, Nychia cirrosa, Flabelligera affinis, Pectinaria hyperborea, Thelepus circinnatus* etc. — Further, from a few localities in deeper water the Danmark has brought home on the one hand some less known aud rarer forms, e. g. *Harmothoe multisetosa* Moore and *Trophonia hirsuta* G. Ar. Hansen, on the other hand a single new species of the genus *Harmothoe.*

Among the commoner forms interest is attached to the species *Nereis zonata,* which occurs in large numbers, some of the individuals in the epitokous form, and also to *Scalibregma inflatum,* of which the variety *corethrura* set up by Michaelsen is present in quantities. It appears on examination, as also from some notes by the zoologist of the Expedition in the Journal of the Danmark, that the form in question is not a variety, but must be the hitherto unknown, epitokous form of *Scalibregma inflatum.*

Polynoidæ.

Nychia cirrosa Pall.

1865 Malmgren p. 58.
1883 Levinsen p. 195.
Localities:

St. 18.	Danmarks Havn	ca. 8 m	24/6	06.
„ 45.	„ „	6—12 „	8/7	06.
„ 57.	„ „	15—20 „	8/8	07.
„ 62.	Stormbugt	10—20 „	20/8	07.
„ 72.	„	30 „	10/9	07.

A number of individuals and some fragments; all typical specimens.

Harmothoe multisetosa Moore.

Pl. XXVII, figs. 2, 5. Pl. XXX, figs. 16, 17, 19, 20.
1902 Moore p. 267, *Lagisca multisetosa.*
Locality: St. 104. 76° 6′ N.L., 13° 26′ W. L.; 200—250 m. 28/7 08.

From the above locality there are 3 fragments of a Polynoid, belonging in all probability to one individual and in this case certainly composing the whole animal. Thus, the elytra-bearing segments correspond with the rule: 1, 3, 4, 6 etc. up to segment 22, then the elytra are again found on the segments 25, 28 and 31. The whole animal consists of 39 bristle-bearing segments, with no elytra on the last 7 of these. From the measurements of the three available fragments the animal has a length of 26 mm.; the greatest breadth, which falls about the 10th segment, has been ca. 8. mm., including the parapodia; without parapodia the breadth measured at the same place is ca. 4 mm. The cephalic lobe is very deeply incised anteriorly, the projecting lateral portions are strongly arched and run out into a small, thin point. The form of these lateral portions most nearly resembles a couple of Nereid palps, but here the point is not detached as an independent joint. The two hindmost eyes lie relatively far from one another, near the posterior margin of the cephalic lobe, medially from the basal part of the lateral lobes. The

front eyes, which are somewhat larger than the posterior, lie more to the side on the boundary line of the dorsal surface of the cephalic lobe towards the sides. The median antenna is almost of the same length as the palps and ends, like these and the tentacular cirri, in a short, thread-like filament; the paired antennae are as nearly as possible double as long as the unpaired antenna's basal part and decrease evenly in thickness towards the point. The unpaired antenna and the tentacular cirri are sparsely beset with small, scattered cilia,

The elytra are partly of a triangular form with rounded corners, partly more elongated, reniform to egg-shaped. The surface is densely beset with small, conical bodies with a broad base; between these are long, pointed spines, which under a stronger magnifying power show an extremely fine, often slightly curved point. Along the posterior and outer margins of the elytra are a few scattered cilia. The arrangement of the spines is not the same in all the elytra; on the anterior they are to a great extent evenly scattered over the whole surface of the elytron, yet in such a way that they are largest and densest towards the posterior margin, as is shown in fig. 5. In the elytra further back they are restricted more to the middle, where they are arranged, as Moore l. c. p. 268 writes, "notably in a broad irregular band, which passes across the middle of the scale in its long direction". In the specimen of the Danmark Expedition, however, it has not been possible to follow this condition in the elytra further back, as most of the elytra are wanting and almost all those present have fallen off and lie loose in the bottle.

The notopodial part of the parapodium is much less prominent than the neuropodial, which forms a vertical leaf with rounded margin and running out in the niddle into a sharply marked, cirrus-like prominence surrounding the ventral acicle. The dorsal cirrus is fairly long with long end-filament and thinly beset with cilia.

The bristles of the dorsum have the usual sword shape with transverse rows of spines, which increase evenly in length from the tip of the bristle downwards and again become successively smaller towards the basal part of the bristle. The uppermost dorsal bristles (most dorsal) are more strongly bent than the others; those in the middle are the straightest. — The ventral bristles are slender, with long shaft, beset with very long spines; the point of the bristle is somewhat strongly curved, with a long tooth under the point which bends somewhat outwards, away from the point of the bristle. The most ventral of these bristles have a comparatively short terminal leaf and seem all to have no tooth under the point; those nearest the notopodium have a long, narrow terminal leaf and their point is alnost straight (fig. 19).

As the present species shows a rather great resemblance in essential points to a form described by MOORE from Mc Cormick Bay under the name of *Lagisca multisetosa,* I have thought it best, even though there are distinct differences present, to refer it to this species, the more so as MOORE also seems to have had only one, by no means perfect specimen at his disposal. The difference in size is inconsiderable; MOORE's specimen measured 11 mm. (20 anterior segments); the corresponding piece of the present specimen measured ca. 10 mm. The dorsal plates resemble each other, being as MOORE writes: "thin, membranous, translucent and fairly adherent". The small, microscopic bodies on the scales seem to be quite the same in both forms, as will appear from a comparison of MOORE's figures with mine. In addition to these small bodies there are in both forms some larger pointed spines, which in the specimen of the Danmark Expedition, however, seem somewhat more prominent than in the species from Mc Cormick Bay; they are pretty well scattered over the whole upper surface of the elytra, most numerous on the hind margin, and the belt running across the scale in its long direction, which MOORE describes, is not so distinctly marked here; the single spines are very large and give the scale a characteristic appearance, which seems rather different from MOORE's form. I may add here, however, that these spines are not so numerous on all the scales, nor so long in proportion to the size of the scale, as in the example I have figured, which is one of the anterior. The "twelve or fifteen prominent soft papillae of various heights and with rounded summits", which MOORE mentions and figures in his form, are not at all present in the specimen of the Danmark Expedition. I do not attach much weight to this last feature, however; these papillae in MOORE's figure greatly ressemble those that are found in larger or smaller quantity in *Harmothoe imbricata* and *Harmothoe rarispina,* which are often quite wanting and occur on the whole so capriciously and in varying forms, that it is a question whether they really belong to the normal animal or are rather pathological formations of some kind or other, possibly of a parasitic origin.

With regard to the bristles, the resemblance is unmistakable. The remarkable form especially of the tooth under the point of the dorsal bristles, which I have described above, seems to me to speak for the specific identity of the two forms; the condition or relation will be seen distinctly on comparing MOORE's and my figures, and MOORE also refers to it in his description. He says: "the accessory process far out, running first parallel to the principal point and then diverging from it, very slender, sharp-pointed and long". — That MOORE calls the dorsal bristles "rather long and slender", whilst I

find the same bristles in the Danmark Expedition's specimen strong and too heavy to suit the description "slender", can hardly be ascribed very great importance. Altogether, I find the resemblances so great, that it is reasonable and justifiable to regard the two forms as specifically identical, so long as the material is no greater than it is.

Harmothoe imbricata (L.).

1865. Malmgren p. 66.

Localities:

St. 16b	Danmarks Havn	ca. 10	m.	17/8 06.
„ 18ea	„ „	ca. 8	„	24/8 06.
„ 20e	„ „	ca. 10—20	„	19/9 06.
„ 21	„ „	6—10	„	20/9 06.
„ 23	„ „	0—ca. 10	„	22/9 06.
„ 31	„ „			7/10 06.
„ 33	„ „	ca. 10	„	13/10 06.
„ 43	„ „	6—10	„	1/7 07.
„ 45	„ „	6—12	„	8/7 07.
„ 50	„ „	8—12	„	22/7 07.
„ 57	„ „	15—20	„	8/8 07.
„ 62	Stormbugt	10—20	„	20/8 07.
„ 65	Danmarks Havn	10—20	„	25/8 07.
„ 66	Stormbugt	30	„	28/8 07.
„ 68	Off Cape Bismarck	40—60	„	2/9 07.
„ 72	Stormbugt	30	„	10/9 07.

Numerous specimens are present from the above stations of the usual, well-known varieties which occur in this species.

Harmothoe rarispina (Sars).

1860. *Polynoe rarispina* Sars p. 60.

1865. *Lagisca rarispina* Mgrn. p. 65.

Localities:

St. 65	Danmarks Havn	10—20	m.	25/8 07.
„ 72	Stormbugt	30	„	10/9 07.
„ 72c	„	16—20	„	9/9 07.

This form is relatively scarce, only 4 specimens in all occurring. One individual is remarkable for its size, being 60 mm., not including the extended proboscis.

Harmothoe Sarsi (Kinb).

1865 Malmgren p. 75.

Locality:

From St. 31, Danmarks Havn, there is a defective, badly preserved specimen.

Harmothoe nodosa (Sars).

1865 Malmgren p. 61, *Eunoe Oerstedi.*
1865 Malmgren p. 64, *Eunoe nodosa.*
1879 Théel p. 7, *Polynoe scabra.*
Locality:
St. 63, Stormbugt, 10—20 m. $^{20}/_{8}$ 07.
Some fragments of rather large specimens.

Harmothoe villosa Mgrn.

1865 Malmgren pp. 79—80.
Locality:
St. 15. 76° 35′ N. L., 18° 26′ W. L. 150 m. $^{14}/_{8}$ 06.

Of this species there is a fragment consisting of the first 9 segments. It is badly preserved and all the elytra are wanting. That it belongs to this species, however, is shown sufficiently clearly by the bristles, the form of which is very characteristic and agrees exactly with the description and figures of MALMGREN.

Harmothoe capitulifera n. sp.

Pl. XXVII, figs. 1, 3, 4, Pl. XXXI, figs. 25, 26, 27, 28, 29.

So far as I can see, this species has not hitherto been described. It seems to me to show most resemblance to a form described by AUGENER under the name of *Eunoe Dybowskyia (Eunoe nodosa* M. Sars var. *Dybowskyi),* but close examination shows that it cannot be referred to this form. I obtained certainty of this through friendly information from Mr. AUGENER, to whom I sent a preparation of an elytron and a parapodium.

The material available consists of three fragments, which all, so far as I can see, belong to one individual.

The cephalic lobe is somewhat broader than long, the proportion of length to breadth being as 7 to 9. Anteriorly it has a broad and very deep incision; each of the two lateral halves run out into a rounded, papilla-like terminal part which is strongly curved out to the side. The hindmost eyes are close to the posterior margin of the head, widely separated from one another, each of them almost in a straight line from the points of the lateral lobes, so that lines drawn from these and touching the outer periphery of the two eyes would be almost parallel. The front eyes lie on the sides of the head, so that both are not fully visible at the same time, when the head is viewed from above. The unpaired antenna is wanting; its basal part, which is present, is fairly thick and has almost the same length as the two paired antennae, not including the terminal filament of the latter, which is just as long as the antenna itself. The

palps are very thick and plump and end in quite a short filament. Each of the tentacular cirri ends with a filament which is almost a third part of the whole length of the cirrus. Antennae and tentacular cirri are densely beset with large, thread-shaped papillae, each of which is slightly swollen at the tip.

The few elytra present are regularly reniform; their surface is beset with rather large, head-shaped bodies, distributed in the following manner: The largest form a dense group on the hindmost lobe of the scale. They are here so dense that they almost touch one another. There is also a dense row along the whole outer margin of the scale, the hindmost bodies in which are the largest, becoming successively smaller towards the front end of scale. On the remaining part of the surface of the scale the bodies are to some extent evenly distributed; they are largest nearest to the outer margin of the scale and become gradually smaller in towards the middle, until those towards the inner margin are quite small. — Examining these head-shaped bodies under a higher magnification we find, that they are more or less globular and attached to the surface of the scale by a short, thick neck. They are beset with conical prominences, which are nowhere pointed however, but everywhere abruptly truncated. How far these prominences have originally been true spines, is difficult to determine with certainty; if so, they have everywhere been broken off in the elytra present, as they do not run out to a point at any place; there is one feature, however, which might indicate that they are not broken or rubbed spines, namely, that in the outermost end of several of these prominences there is a hook, by which the point becomes slightly double. This condition recalls the manner in which the small bodies end in *Nychia Amondseni* Mgrn. (Malmgren 1867, T. I, fig. 4E). In other words, the point of the prominences mentioned does not resemble a broken surface (see fig. 3).

The parapodium is low, the notopodial part being very little prominent; the acicles lie close to one another and are comparatively heavy in their proximal half; the cirri are short and beset with papillae. — The ventral bristles have no tooth under the point, with exception of some few — probably only two on the whole — nearest the dorsum, which run out into a straight point; the end-leaf of these is also rather different in form from the remaining ventral bristles, being much longer and narrower (fig. 29). The central, ventral bristles have a rather long, slightly bent point; where the tooth-equipment of the end-leaf begins, there is uppermost a single tooth or a couple of single, large, pointed teeth; just under these begin the usual transverse rows of spines, which decrease more or less evenly

in length downwards towards the proximal part of the end-leaf; they terminate a little above the place where the latter has its greatest breadth (fig. 28). — The dorsal bristles, all of which are sword-shaped, are somewhat different according to their position in the parapodium. The most ventral are the least bent, and in regard to the tooth-equipment these are rather different from the others; on each side they are provided with two rows of long, straight, pointed spines, which as it were conclude the ordinary tooth-equipment in transverse rows (fig. 25). In the remaining dorsal bristles these spines are bent teeth, which are curved up towards the point of the bristle (fig. 27). The bristles highest up on the dorsum are very strongly bent; in this regard they recall some of the bristles which are found in *Nychia cirrosa;* in *Nychia,* however, there are also very thin bristles running out into an almost thread-like, long, flexible point, which is not the case in this form, which is a typical *Harmothoe* (*sensu* LEVINSEN).

Sigalionidæ.

Pholoe minuta (Fabr.).

1865. Malmgren p. 89.

Locality:

St. 18.	Danmarks Havn		ca. 8 m.	24/8 06.
„ 23.	„	„	0—10 „	22/9 06.
„ 45.	„	„	6—12 „	8/7 07.
„ 59 b.	„	„	upper layers	14/8 07.
„ 69.	Stormbugt		20—30 m.	2/9 07.

Only a single specimen is present from each of the stations mentioned.

Phyllodocidæ.

Eteone arctica Mgrn.

1867. Malmgren p. 27.

Localites:

St. 23.	Danmarks Havn		0—10 m.	22/9 06.
„ 31.	„	„	0—10 „	7/10 06.

Some few specimens are present from these stations.

Eteone flava Fabr.

1865. Malmgren p. 102.

Locality:

St. 18.	Danmarks Havn	ca. 8 m.	24/8 06.

Two specimens.

Nephthydæ.

Nephthys Malmgreni Théel.

1879. Théel, p. 26.

Locality:

St. 98 d. 77° N. L., 28½° W. L. 300 m. 22/7 08.

One specimen. So far as I can see, this form has not hitherto been met with at Greenland. According to Théel it is very common in the Kara Sea, where it is said to occur at least just as commonly as *N. ciliata.* It is also known from Spitzbergen, Finmark and Bering Sea, and thus seems to have a wide distribution within the arctic region.

Glyceridæ.

Glycera capitata Ørst.

1843. Ørsted p. 196.
1883. Levinsen p. 62.

Locality:

St. 96. 76¾° N. L., 18° W. L. (off Maroussia) 160—178 m. 22/7 08.
One specimen.

Onuphidæ.

Onuphis conchylega Sars.

1867. Malmgren p. 66.

Localities:

St. 15.	76° 8′ N. L.,	18° 26′ W. L.	ca.	10 m.	17/8 06.
„ 99.	77° —	18½° —		300 „	22/7 08.
„ 104.	76° 6′ —	13° 26′ —		200—250 „	28/7 08.

One specimen is present from each of the above localities. — In the specimen from St. 99 the tube is beset — instead of the ordinary stones — with a species of conical Foraminifer; here and there is a single stone and at one place there is a branch of a Bryozoa colony, which is so long that it reaches outside the tube to both sides.

Lycoridæ.

Nereis zonata Mgrn.

Pl. XXVIII, fig. 6. Pl. XXX, figs. 18, 22.

1867. Malmgren p. 46.
1898. Michaelsen p. 124. *Nereis arctica.*

Localities:

St. 48.	Danmarks Havn	6—12 m.	18/2 07.
„ 56.	„ „	10—15 „	28/7 07.

St. 62.	Stormbugt	10—20 m.	20/8 07.
„ 63.	„	10—20 „	20/8 07.
„ 70.	Danmarks Havn	20—30 „	4/9 07.
„ 71.	Off Cape Bismarck	15—20 „	4/9 07.
„ 72.	Stormbugt	30 „	10/9 07.

This species is very abundantly represented; there are specimens from all the stations mentioned, several from some of them and many from one, namely St. 63. There are large and small individuals and among them 4 epitokous forms, 3 of which were taken in July, the 4th in August. Two come from Danmarks Havn and were taken respectively on the 18th and 21st of July 1907 among the Laminaria at a depth of ca. 8—16 m. The third specimen was taken in Stormbugt, pelagic among the drift-ice on the surface of the water, 0—1 m., and the fourth lastly comes from Hvalrosodden, where it was taken near the beach drifting past in the current on August 20th 1906. Two are females and the other two males. The two females measure respectively 89 and 72 mm. in length; both lack some of the last segments and have perhaps been about 1 cm. longer. The length of the one male is 53 mm. and is complete, the second, which like the females lacks some segments, measures 38 mm. The material is naturally too small to be able to draw conclusions with regard to a difference in size between the two sexes. Counting the untransformed parapodia I found 21 in both the females; MICHAELSEN has 20, stating that "21te Ruder zeigt die Umbildung fast vollendet". It is possible that this feature varies somewhat in different individuals, as the transition is not very abrupt between the untransformed and transformed parapodia but extends over ca. 2—3 segments. In the males I count 17 untransformed parapodia and find the 18th practically completely transformed. The male individuals are more strongly coloured than the females; how far this will prove to be the rule, I can naturally not say. A second difference between the sexes seems to lie in the size of the eyes, these in the males seeming larger and more prominent. The first pair of eyes seem to be on the whole larger in both sexes. The ventral margin of the dorsal cirrus is toothed in the male, but not in the female. This, which seems to be the general rule in the epitokous forms of the *Nereis* species, thus applies also to this form.

In my report on the polychaetous Annelids of the "Fram" I have stated, that it would possibly prove, that the two nearly allied forms *N. zonata* and *N. pelagica* "durch Zwischenformen allmälich in einander übergehen", and I based this statement, among other things, on some individuals in which the light transverse belts were very indlstïnct. After going through the more copious material of *N. zonata*

of the Danmark Expedition, I must confess to having no longer any doubt, that the two forms mentioned are separate species, though they are very closely related. On well-preserved specimens they are in general very easily distinguished even from the habit; badly preserved specimens may offer some difficulty, but in such cases a close examination of the bristles will lead to a definite result.

In his work on the Greenland Annelids, W. Michaelsen mentions a female, epitokous specimen of *N. zonata* and is of the opinion that it is the same as *Heteronereis arctica* Ørsted. It is not easy to say, how far Michaelsen is right here; there are not many points of support for such a view in Ørsted's description, to my mind. Ørsted writes that "the head is relatively very large". This does not seem to me to agree; rather large we might admit; in any case it is indeed a relative expression based on an estimate, but Ørsted gives a measure: the head should be "just as long as the four following rings". This at any rate does not agree with the individuals brought home by the Danmark Expedition, in which the length of the cephalic lobe is as nearly as possible equal to the total length of the first two rings. Comparing this with Malmgren's figure of the atokous *N. zonata* the length of the cephalic lobe proves to be shorter than the length of the two first segments together. Comparing the size of the head in the atokous and epitokous individuals of *N. zonata,* I can find no noteworthy difference. — Ørsted's figure of the parapodium does not agree with the condition in *N. zonata,* especially not in the case of the untransformed parapodia (Ørsted l. c. fig. 65). All four parapodial lobes are here evenly and uniformly rounded; this does not appear in my specimens, where the lobes are pointed, triangular in form. Even if there is the possibility that Ørsted's drawing is not very correct, yet the resemblance between his figure and the condition in *N. zonata* is far too slight to give any support to Michaelsen's view. It seems to me, that Ørsted's figure agrees far better with the condition in *Nereis pelagica,* of which I have a large material from the Færoes. In the case of this form I have also used the opportunity for a comparison of the pigmentation — having in mind the question of the specific identity of *N. zonata* epit. and *Heteronereis arctica* Ørsted — and I have found great individual differences, both in regard to the tone of colour, which may vary from pale reddish to a strong blue-violet, and to the distribution. I believe, that we should be careful in drawing conclusions with regard to similarity or dissimilarity in this connection. For me the matter stands as follows. There is very little probability, that *Heteronereis arctica* Ørsted and *N. zonata* epitok. are identical, and it is impossible to prove that they are. Malmgren's name *N. zonata* should therefore

be retained. The only thing which in my opinion could definitely settle the quéstion, would be ØRSTED's original specimens, but these are unfortunately quite lost.

Regarding the relation between the two species *N. pelagica* and *N. zonata,* I am of the opinion after close comparison, that the following differences may be regarded as constant. *N. pelagica* never has light transverse bands, which are more or less conspicuous in *N. zonata.* In *N. pelagica* the parapodial lobes are evenly rounded, in *N. zonata* triangular, running out to a broad point. In *N. pelagica* the end-leaf of the bristles provided with a short terminal joint are shorter and more curved than in *N. zonata.*

Hesionidæ.

Castalia Fabricii (Mgrn.).

1867. Malmgren p. 32, *C. arctica.*
1878. Théel p. 37.

Localities:

St. 18.	Danmarks Havn		ca. 8 m.	24/8 06.
„ 23.	„	„	0—10 „	22/9 06.
„ 31.	„	„	0—10 „	7/10 06.
„ 45.	„	„	6—12 „	8/7 07.

Several specimens are present from these stations.

Syllidæ.

Syllis Fabricii Mgrn.

1867. Malmgren p. 44.

Locality:

St, 91. Stormbugt 2—12 m. 12/6 08.

There is only one specimen of this species, which was also found by the Sverdrup Expedition and which I determined as belonging to *Syllis Fabricii* Mgrn. I have learnt later, that there is no specimen of this species in the Stockholm Museum and that it would thus be impossible to make certain of the identity. I follow LEVINSEN here however, at least provisionally, who has retained MALMGREN's *S. Fabricii* for the same Greenland species (LEVINSEN I p. 248).

Syllis incisa Fabr.

1867. Malmgren p. 44.

Locality:

St. 57a. Danmarks Havn 16—20 m. 8/8 07.

There is one specimen from this locality.

Spionidæ.

Spio filicornis Fab.

1867. Malmgren p. 91.

Locality:

St. 31 Danmarks Havn 0—10 m. 7/10 06.

One specimen.

Ariciidæ.

Aricia Cuvieri Aud. & Edw.

1833. Annales des sc. nat., Vol. 19 p. 397.
1873. Sars p. 31.

Localities:

St. 23.	Danmarks Havn		0—10 m.	22/9 06.
„ 42.	„	„	0—4 „	29/6 07.

A number of specimens.

Aricia armiger Mull.

1867. Malmgren p. 72.

Localities:

St. 18.	Danmarks Havn		ca. 8 m.	24/8 06.
„ 45.	„	„	6—12 „	8/7 07.

A number of specimens.

Scalibregmidæ.

Scalibregma inflatum Rathke.

Pl. XXVIII, fig. 7, 8, 9. Pl. XXX, fig. 21.

1843. Rathke H.
1844. Ørsted A. S.
1846. Sars M. p. 91.
1859. Danielssen D. C.
1867. Malmgren p. 186.
1879. Théel Hj. p. 51.
1883. Levinsen p. 133.
1885. Mc Intosh p. 359.
1892. Marenzeller E. von.
1894. St. Joseph de p. 103.
1898. Michaelsen, W. p. 127.
1902. Moore p. 275.
1904. Ashworth.
1908. Mc Intosh p. 379.

Between 20 and 30 specimens of this form are present in the material. On comparing these individuals with the other material of *Scalibregma* in the Museum, I have found that they are in every

respect typical *Scalibregma inflatum;* only the bristles are extremely long, silky and soft. In this regard they agree with Michaelsen's var. *corethrura.* They are all large individuals, of about 40 mm. in length on an average. The only specimens of this species in the Museum, which exceed these in size, are some individuals from the Kara Sea, taken by Th. Holm on the Dijmphna; the largest of the latter has a length of 85 mm., a size which surpasses all the statements I have seen. In his paper on the anatomy of the *Scalibregma* Ashworth states, that his largest specimen, which measured 56 mm., "is one of the largest specimens yet recorded". Compared with this the specimen from the Kara Sea is a perfect giant. I may remark, however, that my measurements do not pretend to be completely accurate, as the state of preservation of the animal did not permit of exactness; a portion of the posterior region for ca. 1 cm. is thin and pulpy, but I have taken account of this and measured the length in such a way, that my statement by no means exceeds the actual length. The greatest thickness of the same individuals is ca. 15 mm. The second specimen from the Kara Sea is a good deal smaller, but an exact measurement can still less be given here, as a large piece of the posterior part of the animal is wanting, probably some cm. The part remaining is ca. 40 mm. That the size of this species varies within very wide limits, as Ashworth l. c. p. 245 notes, I can confirm to the fullest extent from the material in the Museum here, as also that the species seems to have a surprising power to adapt itself to different conditions. In the smaller, enclosed waters with slight salinity the individuals seem to be very small. Specimens are present from the Danish waters, the Skagerak, Kattegat, Hellebæk and Baltic, and of these the Skagerak individuals are the largest whilst the smallest come from the Baltic.

In the Danmark Expedition's material there are some well-preserved specimens, which seem also to have kept their colour very well. This in all individuals is distinctly yellow, a mixture of sulphur yellow and light ochre. On the distended parts of the body the colour is lighter, to almost whitish, and the males are on the whole lighter than the females, especially on the parts where the genital products shine through. The spermatozoa are white, namely, whilst the eggs are distinctly yellow, in colour perhaps a little darker and a little more reddish that the outer skin. The projecting proboscis shows a characteristic, bluish-gray colour, which is also found on the anal cirri.

Of greatest interest, however, to my mind, in the specimens brought home by the Danmark Expedition, is the manner in which they were taken. In two cases it is stated, that they were taken

pelagically at the side of the ship on the 12th and 13th of September 1907, and for the rest, that they were taken *pelagically* under the ice or frozen-in in this, on the 24th of September 1906. On looking through the Danmark's Journal, further, I find the following remarks by the zoologist of the Expedition, which I cite *in extenso.*

"Many bristle-worms are met with frozen-in in the ice; they lie right on the top or as much as ca. 3 inches down; in the first case they are as a rule dead, in the last case the water round about them is not frozen, even though it may be so above them; they then lie and twist about in a hole with water or broken ice when the overlying ice is removed; the same worms are also seen very commonly wriggling about in all layers of water under the ice, or they are attached to the underside of this by their one end; they collect especially at places where refuse from the ship is frozen-in in the ice; or they attach themselves in the same manner to the body of the ship and wriggle along this".

This account of these animals in no way agrees with the pictures we are accustomed to form regarding the mode of life of the *Scalibregma;* they live usually in the sea-bottom, in a similar manner to *Arenicola* and dig down to a depth of ca. "2 feet", as Danielssen already remarked. That they are able to swim, however, is also noted by the same author, as he writes, that they swim "with the greatest activity and move about whilst swimming exactly like a leech".

The phenomenon described by the zoologist of the Danmark Expedition cannot, naturally, be regarded as an ordinary chance case of swimming. We have here innumerable individuals leaving their usual abode and moving up into the upper water-layers, and on examining them we find, in the first place, that they are found to be streaming full of sexual products, and in the second place to be transformed in a suitable manner, as they are provided with long, swimming bristles. The phenomenon is thus similar to what we know already in the epitokous forms of other Annelid groups. That no eyes seem to be formed in *Scalibregma*, is probably not so important and possibly something characteristic of this form; I may just mention, however, that some pigment spots occur in a straight row on the upper side of the dorsal cirri, spots which however are also found in the typical, untransformed form of *S. inflatum.*

It is my belief, therefore, that Michaelsen's var. *corethrura* is not a variety, but the epitokous, sexually altered form of *Scalibregma inflatum.*

The phenomenon the zoologist of the Danmark Expedition has observed, indicates that the sexual transformation and spawning

migration in this species takes place at a definite time of the year, that is, in the regions discussed here, in the month of September.

Chloræmidæ.

Brada granulata Mgrn.

1867. Malmgren p. 85.

Locality:

St. 99. 77° N. L., 18½° W. L. 300 m. 22/7 08.

One specimen.

Flabelligera affinis Sars.

Localities:

St. 46.	Danmarks Havn	8—12 m.	15/7 07.
„ 48.	„ „	8—12 „	18/7 07.
„ 49.	„ „	8—12 „	21/7 07.
„ 50.	„ „	8—12 „	22/7 07.
„ 57.	„ „	15—20 „	8/8 07.
„ 65.	„ „	10—20 „	25/8 07.
„ 71.	Off Cape Bismarck	15—20 „	4/9 07.

One or several specimens from the above localities. They are large animals on the whole, about 50 mm. long, a few reach a length of 60—70 mm.

Trophonia hirsuta Ar. H.

Pl. XXIX, fig. 11, Pl. XXXI, figs. 23, 24.

1879 Ar. Hansen p. 9.

1908 Mc Intosh p. 541.

There is a very small specimen in the collection, ca. 6 mm long. To make certain of the identity of the species, I have had material on loan from the Christiania Museum aud there is scarcely any doubt, that the specimen belongs to the species mentioned. The differences from the Norwegian specimens, which come from Vadsø, are not greater than might be due to the small size of the individual, perhaps also the locality. The red and reddish-yellow colour, which is distinct in the Norwegian specimens and which is also mentioned by Mc Intosh, is not conspicuous in the individual of the Danmark Expedition, which is a uniform muddy gray over the whole. The dorsal, filiform papillæ seem also somewhat longer in proportion to the size of the animal than in the Norwegian specimens. The bristles agree very well with the figures given by Mc Intosh and G. Ar. Hansen, but the indications of the joints in the ventral bristles are scarcely so conspicuous. Mc Intosh figures a fragment of a specimen from Finmark; I have taken the opportunity to give a figure of the form of the specimen of the Danmark Expedition, Pl. XXIX, fig. 11.

Capitellidæ.

Capitella capitata Fabr.

1867. Malmgren p. 97.

Locality:

St. 23.	Danmarks Havn	0—10 m.	$^{22}/_{9}$ 06.

A single specimen.

Maldanidæ.

Clymene affinis Sars.

1871. G. O. Sars p. 412.
1906. Ivar Arwidsson p. 177. *Praxitella affinis.*

Locality:

St. 18.	76° 47′ N. L., 18° 45′ W. L.	0—4 m.	$^{25}/_{8}$ 06.

There is a single specimen, which seems to agree with the present species. It has not hitherto been known however from arctic waters. The northernmost place from which it has been recorded is Bergen (Arwidsson); it also occurs as far south as Aarhus Bay (Tauber, Ann. Dan. p. 124). The depths given range from 25—250 m. The specimen of the Danmark Expedition was taken in 0—4 m. The bottom is given as "mud with algae".

Amphictenidæ.

Pectinaria hyperborea Mgrn.

1865. Malmgren p. 360.

Localities:

St. 62.	Stormbugt	10—20 m.	$^{20}/_{8}$ 07.
„ 66.	„	10—20 „	$^{20}/_{8}$ 07.
„ 70.	Danmarks Havn	20—30 „	$^{4}/_{9}$ 07.

There are 5 very large specimens in the collection; the tubes have an average length of 60 mm.; further, there is a single, empty tube, which reaches a length of 86 mm.

Ampharetidæ.

Ampharete Goësi Mgrn.

1865. Malmgren p. 364.

Localities:

St. 18.	Danmarks Havn	ca. 8 m.	$^{24}/_{8}$ 06.
„ 21.	„ „	6—10 „	$^{20}/_{9}$ 06.
„ 62.	Stormbugt	10—20 „	$^{20}/_{8}$ 07.

7 specimens in all. A couple of specimens were *in situ* in their tubes, which were composed of parts of plants and to a certain

extent resembled the tubes of certain spring fly larvae, which occur in freshwater.

Terebellidæ.

Scione lobata Mgrn.

1865. Malmgren p. 383.

Localities:

St. 63.	Stormbugt	10—20 m.	20/8 07.
„ 95a.	Sound between Renskaer and Maroussia	ca. 50—100 „	19/7 08.
„ 96.	$76\frac{3}{4}°$ N. L., 18° W. L. (off Maroussia)	160—178 „	22/7 08.

A number of specimens are present from the above localities; but the number is comparatively small when we consider that this species, under favourable conditions, may occur in large quantities. Nor are the individuals large.

Terebellides Stroemi Sars.

1865. Malmgren p. 398.

Localities:

St. 31.	Danmarks Havn	0—10 m.	7/10 06.
„ 42.	„ „	0—4 „	29/6 07.

3 specimens from St. 42, a fragment from St. 31.

Thelepus circinnatus (Fabr.).

1865. Malmgren p. 387.

Localities:

St. 46.	Danmarks Havn	8—12 m.	15/7 07.
„ 48.	„ „	8—12 „	18/7 07.
„ 49.	„ „	8—12 „	21/7 07.
„ 50.	„ „	ca. 10 „	22/7 07.
„ 57.	„ „	15—20 „	8/8 07.
„ 65.	„ „	10—20 „	25/8 07.
„ 71.	Off Cape Bismarck	15—20 „	4/9 07.

This species is present in great quantities. A couple of large bottles have been brought home quite full with this species. The tubes, which are made of sand and Foraminifera, are all twisted about amongst each other and seem to have covered the bottom in a thick layer at the places where they were found. The Sverdrup Expedition brought home a couple of bottles with quite similar material of this species from "Gaasefjorden" and adjacent regions.

Amphitrite cirrata Müll.

1865. Malmgren p. 375.

Locality:

St. 60.	Danmarks Havn	5—20 m.	14/8 07.

A single specimen from this locality.

Laphania Boecki Mgrn.

Pl. XXIX, figs. 10, 12, 13, 14, 15.

1865. Malmgren p. 386.

Locality:

St. 18. 76° 47′ N.L., 18° 45′ W.L. 0—4 m. 25/8 06.

There is only one specimen, which lacks the hindmost rings. There is no doubt regarding its identity; through the kindness of Prof. Théel I have had on loan the single specimen preserved in Riksmuseet of Stockholm, presumably the "specimen unicum mancum", which Malmgren mentions from the Finmark. A few months ago Dr. Wollebæk from Christiania Museum was here and asked permission to examine the animal. The drawings he then made of it have been given me with the greatest friendliness for publication in the present paper.

The Danmark Expedition's specimen is a good deal smaller than Malmgren's; it is only 35 mm. in length. Owing to its state of preservation it is not possible to state with certainty the number of the segments present; they are about 45. — The cephalic lobe, the dorsal aspect of which is slightly arched, is provided with a somewhat prominent margin, which has a straight edge and is beset with ca. 8 small rounded papillae, which give it a slightly wrinkled appearance. The mouth segment is rather large and prominent. On the second to the fifth bristle-bearing rings there are rudimentary ventral parapodia, which, so far as I can see, contain no bristles. These rudimentary parapodia are not mentioned by Malmgren in his description, but they are distinct in his figure (1867. Pl. XII, fig. 68). Ventral bristles begin on the 7th bristle-bearing ring.

Sabellidæ.

Chone infundibuliformis Kr.

1865. Malmgren p. 404.

Localities:

St. 63.	Stormbugt	10—20 m.	20/8 07.
„ 69.	„	20—30 „	2/9 07.
„ 95.	Sound between Renskær and Maroussia	ca. 50—100 „	19/7 08.

Several specimens from the stations mentioned; unfortunately almost all lack the tentacular crown, only two individuals are entire.

Dasychone infarcta (Kr.).

1865. Malmgren l. c. p. 403.

1856. Kröyer p. 21.

1909. Hj. Ditlevsen p. 19.

Only one specimen has been brought home; it agrees well with the specimens obtained by the Sverdrup Expedition in "Gaasefjorden". The size however is very different; whilst some of the Sverdrup Expedition's specimens measured 115 mm. in length, that of the Danmark Expedition is only 52 mm. A feature on which in this case no great weight can be laid, as it probably comes from the difference in size, is that whilst the tentacular crown in the large individuals from Gaasefjorden is contained 3 to 4 times in the length of the animal, here in this specimen of 52 mm. it measures 24 mm.

Serpulidæ.

Apomatus globifer Théel.

1879. Théel p. 66.

Localities:

St. 15.	76° 35′ N. L., 18° 26′ W. L.		150 m.	14/8 06.
„ 16b.	76° 47′ N. L., 18° 45′ W. L.			17/8 06.
„ 96.	$76\frac{3}{4}$° N. L., 18° W. L.	Off Maroussia	160—178 „	22/7 08.
„ 103.	77° 8′ N. L., 16° W. L.		220—280 „	27/7 08.

Single specimens; but from the last two stations only empty tubes.

Serpula vermicularis L.

1867. Malmgren p. 120.

Locality:

St. 103. 77° 8′ N. L., 16° W. L. 220—280 m. 27/7 08.

A single specimen, attached to a hydroid branch; on the *Serpula* tube again a couple of specimens of *Spirorbis borealis.*

Pomatocerus triqueter L.

1867. Malmgren p. 121.

1884. Levinsen p. 200.

Localty:

St. 72. Stormbugt 30 m. 10/9 07.

A single empty tube.

Spirorbis spirillum L.

1863. Mørch p. 92.

1884. Levinsen p. 204.

Localities:

St. 16.	76° 47′ N. L., 18° 45′ W. L.	ca. 10 m.	17/8 06.
„ 35.	Danmarks Havn	10—15 „	11/10 06.
„ 36.	„ „	10—15 „	13/10 06.

Many specimens attached to Laminaria and other algae.

Spirorbis Verruca Fabr.

1863. Mørch p. 85.
1884. Levinsen p. 203.

Locality:

St. 103. 77° 8′ N. L., 16° W. L. 220—280 m. 27/7 08.

A single specimen from this locality.

Spirorbis borealis D.

1863. Mørch p. 83.
1884. Levinsen p. 203.

Locality:

St. 18. Danmarks Havn ca. 8 m. 24/8 06.

Numerous specimens on algae.

Hydroides norvegica Gunn.

1867. Malmgren p. 120.
1884. Levinsen p. 201.

Locality:

St. 103. 77° 8′ N. L., 16° W. L. 220—280 m. 27/7 08.

A couple of specimens from this locality.

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1909. DITLEVSEN, HJ.: Annulata polychæta. — Report of the second norw. arctic exped. in the „Fram“ 1898—1902.

Plate XXVII.

PLATE XXVII.

Fig. 1. Harmothoe capitulifera n. sp. Head.
— 2. Harmothoe multisetosa, Moore. Head.
— 3. Harmothoe capitulifera n. sp. Part of an Elytron, showing the head-shaped bodies.
— 4. Harmothoe capitulifera n. sp. Elytron.
— 5. Harmothoe multisetosa, Moore. Elytron.

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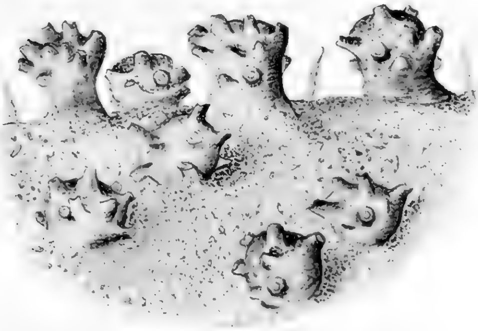

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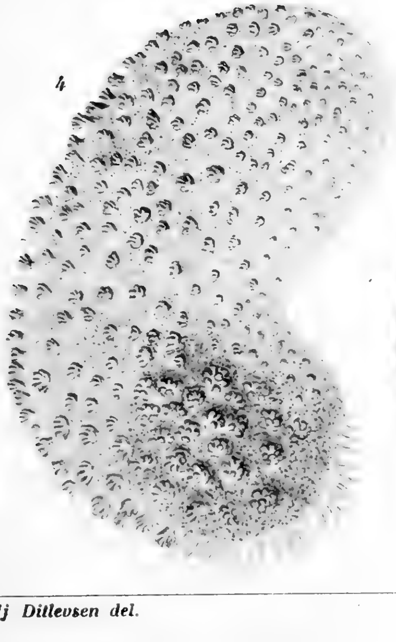

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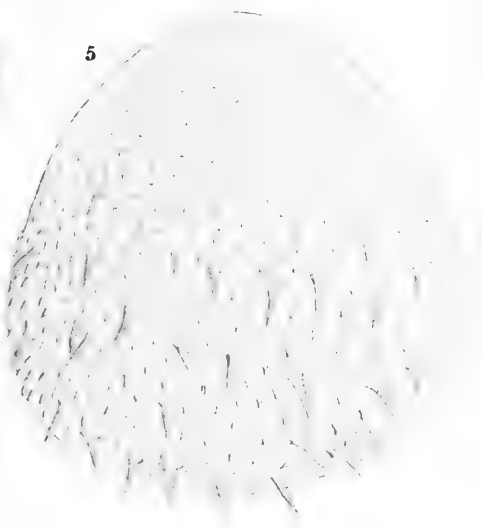
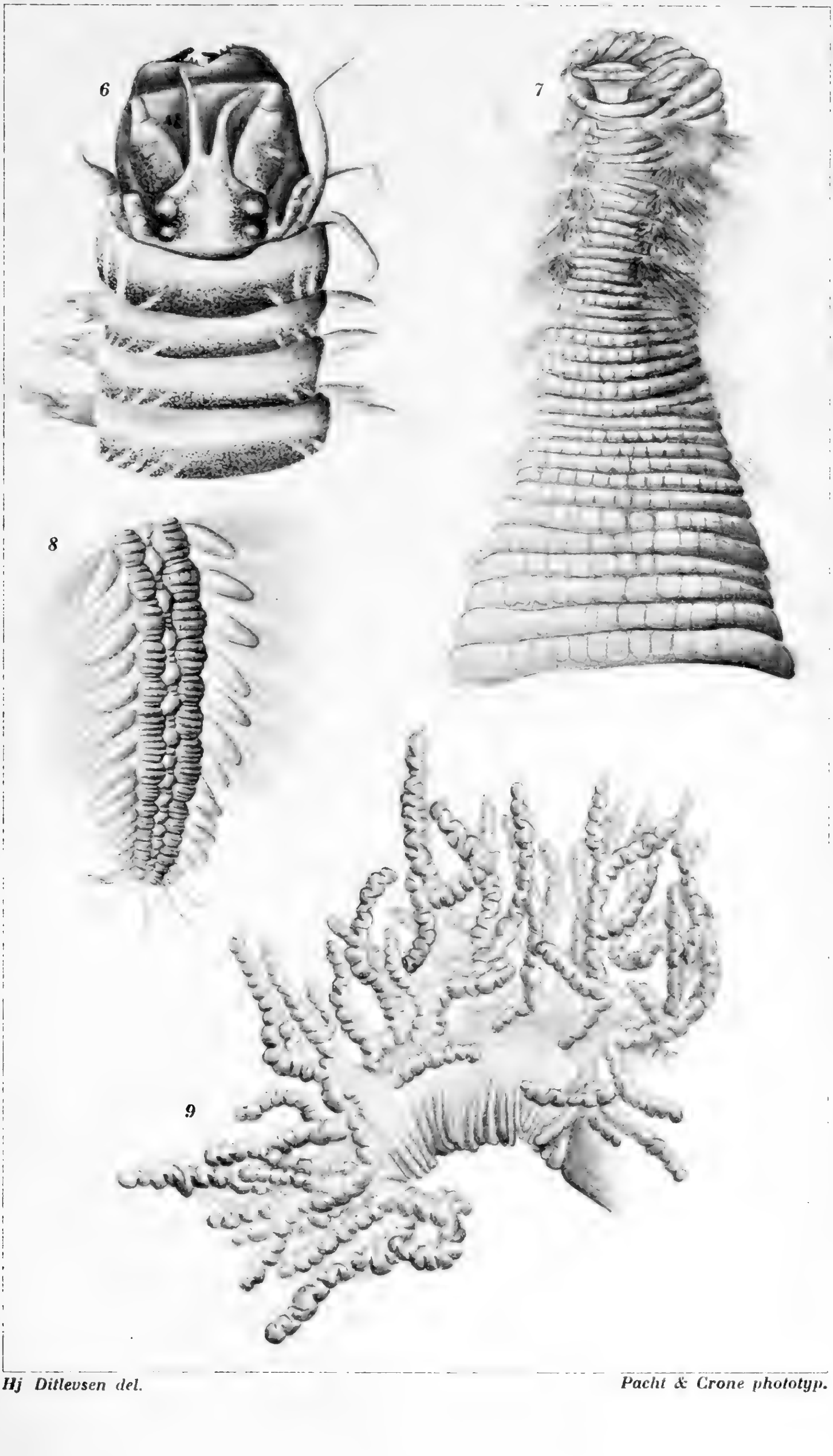


Hj Ditlevsen del. *Pacht & Crone phototyp.*

Plate XXVIII.

PLATE XXVIII.

Fig. 6. Nereis zonata, Malmgren. ♂ Front part.
— 7. Scalibregma inflatum Rathke. Epitokous form. Front part.
— 8. Scalibregma inflatum Rathke. Epitokous form. Tail of the same specimen.
— 9. Scalibregma inflatum Rathke. Epitokous form. Gill.



Hj Ditlevsen del. Pacht & Crone phototyp.

Plate XXIX.

PLATE XXIX.

Fig. 10. Laphania Boecki Malmgren. Front part.
— 11. Trophonia hirsuta Arm. Hansen.
— 12. Laphania Boecki Malmgren. Uncinus avicularis. $^{640}/_{1}$
— 13. Laphania Boecki Malmgren. Uncini aviculares, from above. $^{640}/_{1}$
— 14. }
— 15. } Laphania Boecki. Setæ copillares. $^{465}/_{1}$

PL. XXIX

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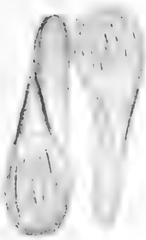

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Wollebæk og Hj. Ditlevsen del.

Pacht & Crone phototyp.

Plate XXX.

PLATE XXX.

Fig. 16. } Harmothoe multisetosa Moore, Dorsal bristles. Zeiss Obj.
— 17. } DD. Oc. 2.
— 18. Nereis zonata, Malmgren. Epitokous form. Dorsal bristle. Zeis Obj. DD. Oc. 3.
— 19. } Harmothoe multisetosa Moore. Ventral bristles. Zeiss Obj.
— 20. } DD. Oc. 2.
— 21. Scalibregma inflatum Rathke. Epitokous form. Furcated bristles. Zeiss Apochr. 3^{mm}. Comp. 4.
— 22. Nereis zonata Malmgren. Bristle with short end-blade. Zeiss Obj. DD. Oc. 3.

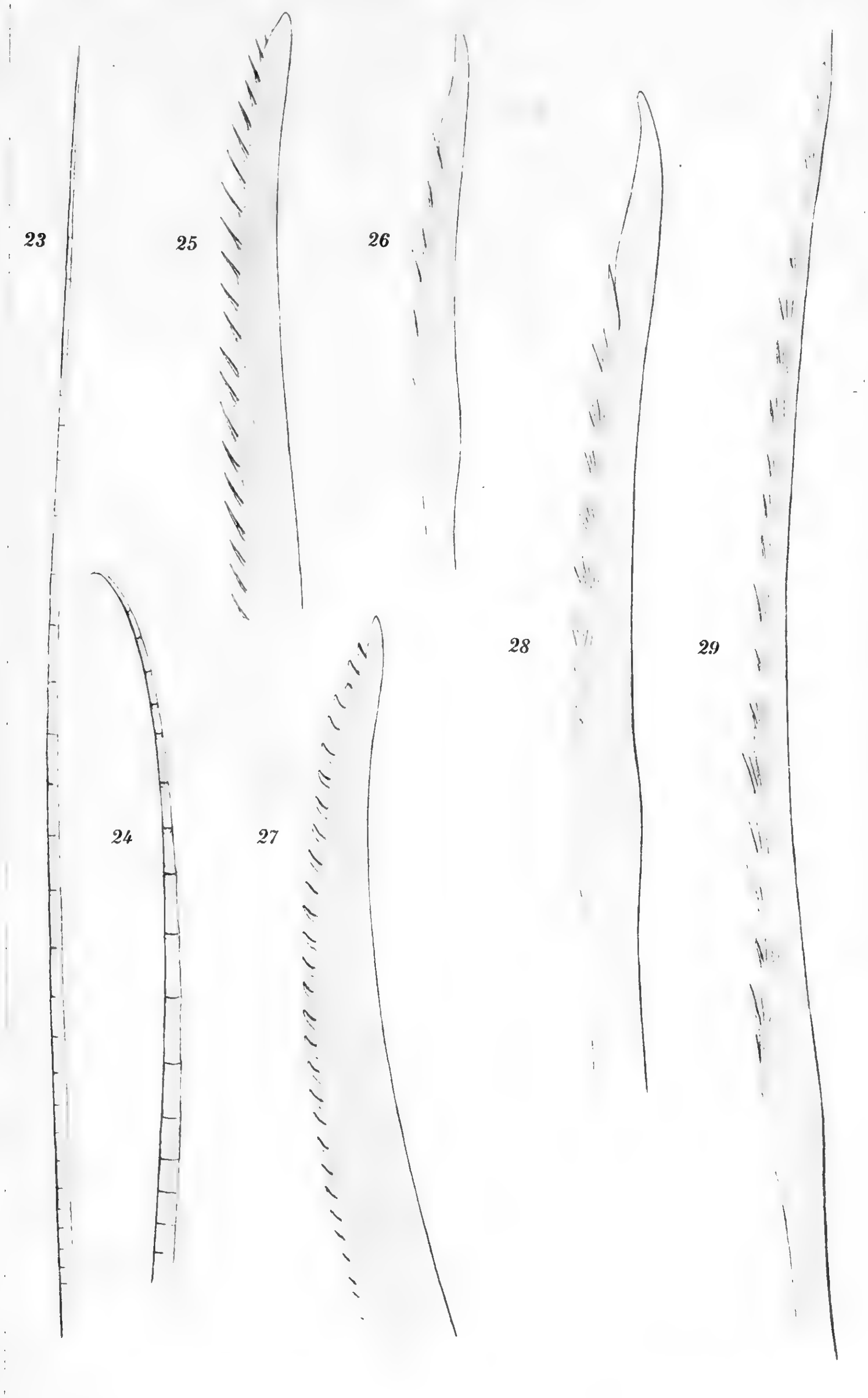
Hj Ditlevsen del.

Pacht & Crone phototyp.

Plate XXXI.

PLATE XXXI.

Fig. 23. Trophonia hirsuta Arm. Hansen. Dorsal bristle. Zeis Obj. E. Oc. 2.
— 24. Trophonia hirsuta Arm. Hansen. Ventral bristle. Zeiss Obj. E. Oc. 2.
— 25. Harmothoe capitulifera n. sp. Dorsal bristle. Zeiss Obj. DD. Oc. 2.
— 26. Harmothoe capitulifera n. sp. Ventral bristle. Zeiss Obj. DD. Oc. 2.
— 27. Harmothoe capitulifera n. sp. Dorsal bristle. Zeiss Obj. DD. Oc. 2.
— 28. } Harmothoe capitulifera n. sp. Ventral bristles. Zeiss Obj.
— 29. } DD. Oc. 2.



Hj Ditlevsen del. *Pacht & Crone phototyp.*

X.

ON JURASSIC AND CRETACEOUS FOSSILS FROM NORTH-EAST GREENLAND

BY

J. P. J. RAVN

1911

CONTENTS

I. Introduction.

One of the results of the Danmark Expedition has been a very considerable and important extension of our knowledge with regard to the marine, Jurassic and Cretaceous deposits of East Greenland and thus of the Arctic zone as a whole. The Expedition brought home a very complete material of these deposits, from regions whose geological structure had hitherto been quite unknown or only very imperfectly studied. This material was intrusted to me for investigation by the Committee for the Danmark Expedition, and as it proved to have come from deposits which were almost all younger than the Jurassic deposits investigated by the Danish expeditions of 1891—92 and 1900, in regions of East Greenland somewhat further south, and as no material for comparison existed in Copenhagen, the Committee voted me the necessary funds for a journey to Munich. Here Professor Rothpletz with the greatest willingness permitted me to use the rich collections of the Palæontological Museum there for comparison, and I would express my best thanks to him here for this permission. — On the return journey from Munich I made a short stay at Göttingen, where the well-known expert on the Jurassic deposits of the Arctic regions, Professor Pompeckj, was so kind as to look through a part of my material, especially the Ammonites. For the suggestions and information Prof. Pompeckj gave me on this occasion I am extremely indebted to him. As, further, a number of species occurred in the material, which had earlier been described by Tullberg and Lundgren from the Jurassic deposits of Nova Zembla and Spitzbergen, I desired to compare my material with theirs and journeyed to Stockholm on my return from Germany. For the friendly permission given me there to make the comparison, it is a pleasant duty to tender my best thanks to Professor G. Holm, the Director of the Zoopalæontological Department of the Riksmuseum.

II. Earlier investigations.

The Jurassic deposits in East Greenland were discovered for the first time by W. Scoresby (jun.) when he was exploring parts of Jameson's Land in 1822. He gives a brief description of the rocks found here (in Neill's Cliffs) and of the stratigraphical features, a description that was supplemented by Jameson. Both of these observers, however, made the mistake of referring these deposits to the Carboniferous system; later investigations have shown that they belong partly to the Rhaetic, partly to the Jurassic. On the Danish expedition to East Greenland in 1891—92 E. Bay and N. E. K. Hartz were able to make more detailled investigations on Jameson's Land and brought home a very considerable material of fossils. The Rhaetic layers proved to contain only plant fossils, which were described by Hartz[1], whilst the animal fossils of the upper layers were studied and described by B. Lundgren[2], who referred the fauna to the Callovian period and states, that the Brachiopods and Bivalves give the fauna a middle-European character. The Cephalopods were unfortunately so badly preserved, that no results could be obtained from them. Regarding this fauna Pompeckj[3] states later, that it possibly contains species from older zones, besides those of the Callovian. — Our knowledge of the Jurassic deposits of Jameson's Land was further extended by the Swedish expedition under the direction of A. G. Nathorst, which investigated the deposits occurring on the east side at Hurry's Inlet. Deposits were also found on the southwest side of Davy's Sound, which according to Nathorst must be referred to the Jurassic[4]. During a later Danish expedition to East Greenland (under the direction of Amdrup and Hartz) the Jurassic deposits on Jameson's Land were again examined in the year 1900. A large material of fossils was brought home, both from the coastal region and from the interior, among other things a quantity of Ammonites which O. Nordenskjöld and H. Deichmann had found in the interior of Jameson's Land. The material was examined and described by V. Madsen, who shows, that Jurassic deposits of different age

[1] N. Hartz: Planteforsteninger fra Cap Stewart i Østgrønland, med en historisk Oversigt. — Medd. om Grønland. 19. Hefte. Kbhvn. 1896.

[2] B. Lundgren: Anmärkningar om några Jurafossil från Kap Stewart i Ost-Grönland. — Medd. om Grønland. 19. Hefte. Kbhvn. 1895.

[3] J. F. Pompeckj: The Jurassic Fauna of Cape Flora, Franz Josef Land, p. 137. — The Norwegian North Polar Expedition 1893—96. Scientific Results. Vol. I. London, Christiania etc. 1900.

[4] A. G. Nathorst: Bidrag till nordöstra Grönlands geologi, p. 298. — Geolog. Föreningens i Stockholm Förhandl. Bd. 23. Stockholm 1901.

occur in this region[1]. The oldest of them must from their fauna be referred to the Dogger, the younger to the Lower Callovian and the youngest to the Lower Volgian (Middle Portlandian).

Jurassic deposits had already been found by that time, however, in the regions further north. On the second German North Pole Expedition (1869—70) investigations were made on Kuhn Island among others, and resulted according to Toula and Lenz[2] in the discovery on the south coast of a brownish, fine-grained, calcareous sandstone, which contained flakes of mica and enclosed coal-layers. In this sandstone were found a number of shells and imprints of various Bivalves. A coarse-grained, fossiliferous sandstone also occurred here. Toula states, that these deposits probably belong to the middle Dogger. A light-gray, very calcareous marl and fine-grained, micaceous sandstone were found on the east side of the same island[3]. As these deposits contained *Aucella* and others, Toula draws a parallel between them and the *Aucella*-layers in Russia (Younger Jurassic and Older Cretaceous). A. P. Pavlow has shown later, that the *Aucellae* to judge from Toula's figures would indicate the presence of the uppermost zone of the Lower Neocomian (and perhaps the Middle Neocomian)[4]. In addition to these *Aucellae* of the Cretaceous however, Toula also mentions, among others, *Belemnites Panderianus* d'Orb. from this locality. If this determination does not rest on a confusion with another species, then older layers must obviously also occur here, as this Belemnite is distributed in Russia from the zone with *Quenstedtoceras Lamberti* to the zone with *Cardioceras alternans.*

The German expedition also found Jurassic deposits at another locality and that over a very extensive region, namely the whole of Hochstetter's Foreland from the south point up towards Cape Seebach. Owing to the very bad state of preservation of the fossils, however, these deposits were misinterpreted and referred — with some doubt — to the Tertiary system (Miocene). The deposits consist mainly of yellowish, in part brick-coloured, fine-grained sandstone with

[1] Victor Madsen: On Jurassic Fossils from East-Greenland. — Medd. om Grønland. 29. Hefte. Kjbhvn. 1904.

[2] Franz Toula: Allgemeine Uebersicht der geologischen Beschaffenheit Ostgrönlands, p. 478. — Die zweite deutsche Nordpolarfahrt in den Jahren 1869 und 1870 unter Führung des Kapitän Karl Koldewey. Bd. II. Leipzig 1874.
Oskar Lenz: Specielle Darstellung der geologischen Verhältnisse Ostgrönlands, p. 505. — Ibidem.

[3] Toula: l. c. p. 491.
Lenz: l. c. p. 497.

[4] A. P. Pavlow: Enchaînement des aucelles et aucellines du Crétacé russe, p. 80. — Nouv. Mèm. Société imp. des naturalistes de Moscou. Tome 17, Livr. 1. Moscou 1907.

numerous casts and imprints hardly determinable to genus and species, which were referred by Toula to the genera *Lucina*, *Cytherea* and *Venus*[1]. Th. Fuchs, who later undertook a renewed investigation of the material, added here two other genera, namely *Astarte* and *Pecten*[2]. He also came to the result, that the fauna might probably be Miocene. As we shall see later, this determination of the age is incorrect, as the Danmark Expedition discovered fossils in the yellowish, sometimes brick-red sandstone on Hochstetter's Foreland, which quite definitely belong to the youngest Jurassic (Malm).

The sedimentary deposits discovered by the 2nd German North Pole Expedition at Flache Bay were also referred by Toula and Lenz[3] to the Tertiary system. Nathorst, who also investigated this part of East Greenland on his 1899 expedition, expressed some doubts as to the correctness of this determination of the age, various conditions seeming to him to suggest the Jurassic — at least for a portion of the sediments. Future investigations must decide this question.

I have thus given quite a brief summary of what has hitherto been known regarding the mesozoic deposits with marine fauna in East Greenland; in the sequel I shall discuss the results of my investigation of the material brought home by the Danmark Expedition from these deposits.

III. The marine, mesozoic deposits investigated by the Danmark Expedition.

1. Stratigraphical conditions.

As already mentioned above, the Danmark Expedition found Jurassic deposits on Hochstetter's Foreland, deposits that had hitherto been erroneously referred to the Tertiary system. The principal collections of mesozoic, marine fossils were made, however, on Store Koldewey Island; not only were fossiliferous Jurassic deposits of somewhat different age found there, but also — at one point — interesting Neocomian deposits with a fauna which is very nearly related to that on the east side of Kuhn Island. Mesozoic fossils were also found further north, in the district round Danmarks Havn, but only in boulders. These boulders are referable partly to the youngest Jurassic, partly to the oldest Cretaceous.

[1] Toula: l. c., p. 477 and 495.

[2] Th. Fuchs: Ueber die während der schwedischen geologischen Expedition nach Spitzbergen im Jahre 1882 gesammelten Tertiärconchylien, p. 5. — Bihang till K. Svenska Vet.-Akad.'s Handlingar, Bd. 8. Stockholm 1883.

[3] Toula: l. c., p. 477.
Lenz: l. c., p. 486.

Regarding the features of the deposits at the different localities I am only able to give a little information, for which my thanks are due to the geologist of the Expedition, HAKON JARNER. A more detailled description of these will be given later in the general part on the geology of North-East Greenland, which H. JARNER has under preparation.

The widest distribution is shown by the deposits mentioned on the east coast of Store Koldewey. The whole of the east coast of this island is formed, according to information from JARNER, of a plateau, which has a height of about 120 m. above the sea in the northern part of the island; towards the south the plateau sinks more and more. It is only in towards the middle of the island that we meet with the high hills of gneiss. Whether this plateau is an abrasion surface or has been formed in another way, I must leave uncertain. Uppermost we find Quaternary formations (moraine, *Yoldia*-clays) and below these the solid rock, which in the middle of the island is formed of sandstone interrupted at a couple of places by gneiss, so that we have 3 sandstone regions on the east coast, the northernmost being the largest and the middle one the smallest (see accompanying Chart, pl. XXXVIII). At the southernmost of the two gneiss points JARNER found the sandstone resting directly on the gneiss, and a few samples of the sandstone further north, which were brought home, contain pieces of gneiss. We thus have here a case of transgression.

In the following the different, marine, mesozoic deposits from North-East Greenland will be discussed, beginning with the oldest and ending with the youngest.

a. **Callovian.**

Deposits belonging to the Callovian were only found at one locality, namely, in the southernmost sandstone region on the east coast of Store Koldewey, down from “Trækpasset”. A number of fossils were found here in a characteristic, brownish, fine-grained sandstone. The fossils were found mainly in pieces of sandstone which lay loose on the surface of the plateau, but the same sandstone formed a solid layer underground. The accompanying list of the fauna (p. 451) will show the species and genera of the fossils from this locality, which I have been able to determine. The principal are undoubtedly the 3 Ammonite species; although they all 3 probably belong to new species, there seems hardly any doubt that we have here a Callovian fauna, as they all appear to be most nearly related to Callovian species, and the other fossils do not seem in any way opposed to this determination of the age. It is interesting, that

representatives of the genera *Cosmoceras* and *Kepplerites* are found here for the first time in Arctic regions in Jurassic deposits; these give the fauna quite a characteristic appearance, recalling that of the West and Middle European Dogger. The genus *Quenstedtoceras* belongs on the other hand to the most typical of the Russian Callovian; yet its presence in the North-East Greenland Jurassic is not by any means certain, as the only specimen available is too imperfect to make a determination of the genus quite safe.

b. Séquanian-Kimmeridgian.

Deposits belonging to this series have not hitherto been discovered in Greenland. It is certain, as we shall see later, that the sandstone deposits found by the 2nd German North Pole Expedition on Hochstetter's Foreland must be referred to these layers, but as mentioned above a great error was made in determining the age of these deposits owing to imperfect material, as they were believed to belong to the Tertiary system. This mistake is excusable, as the fossils (almost exclusively casts of Bivalves) are very badly preserved, so that it is only in the fewest cases that the genus can be determined. The Danmark Expedition, however, succeeded in finding Ammonites in these deposits and, fortunately, Ammonites which are so characteristic that they can be determined with complete certainty. Deposits of the same age with a much better preserved fauna were also found by the Danmark Expedition at different parts of Store Koldewey, on which the two northernmost sandstone regions seem to belong to the Séquanian-Kimmeridgian. The different localities where deposits of this age have been found, may be quite briefly mentioned.

1. "Kløft I". This locality lies near the north end of the northern sandstone region on the east side of Store Koldewey. There is here a narrow ravine with steep walls. The north side of the ravine is covered by great masses of snow, which seem never to melt, whereas the south side, at least in summer, is free of snow. The wall of the ravine here is formed of sandstone layers, which lie approximately horizontal and are covered by moraine deposits. The sandstone is gray in colour, calcareous and contains a good deal of mica. It encloses the remains of a very rich fauna, unfortunately too often in a bad state of preservation. As is shown by the fauna list, 33 species are known from here, most of which however say nothing definite with regard to the age of the deposits. This applies especially to the numerous Lamellibranchs, which belong for the most part to species of little characterized form and appearance. Fortunately, however, we also find here 3 species of the genus *Aucella*, namely *A. kirghisensis*, *A. Bronni* and *A. Sinzovi*. The presence

of these 3 species alone shows, that we have here deposits which must be of the same age as the Alternans-strata in the Russian Jurassic and thus belong to the Séquanian-Kimmeridgian. This determination of the age is fully confirmed by the Cephalopods, which are found together with the *Aucellae*. Thus, we very frequently find *Cardioceras alternans*, the species which has given the Alternans-strata their name. Of doubtful occurrence, on the other hand, is *C. Nathorsti*, a species nearly related to *C. alternans* and described from deposits on Spitzbergen, which according to Pompeckj[1] belong to the Séquanian-Kimmeridgian. Belemnites have also been found in "Kløft I", namely *B. Panderianus* and *B. breviaxis*. Both point in the same direction with regard to the age of the deposits, even though both are also said to occur in layers which are somewhat older than the Alternans-strata.

2. "Kløft II". Close to the south of "Kløft I" lies a second ravine of similar appearance and with quite similar sandstone. Jarner did not succeed in following the separate beds from the one ravine to the other; the layers show a tendency to thin out at the end and thus cannot be followed for any long distance. The sandstone in "Kløft II" contained portions with a very light colour and very glassy surfaces of fracture; the binding material between the sand-grains is formed here of large anhedra of calcite. It is probably some form of concretion. At this locality also a number of fossils, some of which occurred in "Kløft I", were found; for example, *Aucella Bronni* and *A. Sinzovi*. Further, we have *Macrodon Keyserlingi* from this locality, a species found in Europe in deposits that extend in age from the Middle Callovian to the Séquanian. Greater weight must be ascribed, however, to the occurrence of *Cardioceras Nathorsti*. It appears from the fauna, that the sandstone in "Kløft II" is almost of the same age as that in "Kløft I". Yet the faunas are somewhat different in the two ravines, as will be seen from the fauna list. Thus, in "Kløft II" we have such characteristic forms as *Tancredia Jarneri* and a large *Pecten*, which in the sequel is described as *P. cfr. validus*. The sandstone in "Kløft II" is possibly a little younger than in "Kløft I", though it still belongs to the Séquanian-Kimmeridgian.

3. "4. Sænkning". This locality lies much farther to the south that the two mentioned above, but it still belongs to the northernmost of the 3 sandstone regions on the east side of Store Koldewey. The sandstone has here a similar appearance as at the

[1] See A. G. Nathorst: Eine vorläufige Mitteilung von Prof. J. F. Pompeckj über die Altersfrage der Juraablagerungen Spitzbergens, p. 1503. — Geol. Fören. i Stockholm Förhandl. Vol. 32. Stockholm 1910.

other two localities. Where the Mollusc shells are preserved, they seem on the whole somewhat more rubbed, but this probably arises from the fact, that all the fossils found here were taken in loose-lying stones, of the same nature, however, as the sandstone mass. The fauna from this locality is fairly rich, containing at least 26 species. Here again we have *Aucella Bronni* and *A. Sinzovi*, as also *Cardioceras alternans* and possibly *C. Nathorsti.* The discovery of these fossils marks this locality as also belonging to the age of the Séquanian-Kimmeridgian. The other species (mainly Bivalves and Gastropods) do not require to be mentioned in detail; but the occurrence of numerous *Tancredia*, *Cyprina (Cyprimeria?)* and *Astarte* species may be specially noticed.

In the northernmost of the 3 sandstone regions on Store Koldewey Island fossils are only known from the 3 localities mentioned above. The fauna shows, that the sandstone must be approximately of the same age at all 3 localities; it thus seems to form a continuous whole. Somewhat to the south of the southernmost of the localities, "4. Sænkning", the sandstone comes to an end and the gneiss reaches right out to the coast, forming here the northern Gneiss Naze. A little further to the south the gneiss is again replaced by the sandstone for a short distance, until the gneiss reappears once more in the southern Gneiss Naze. The sandstone of this region has the same appearance as in the northern region. On the boundary of the region towards the southern Gneiss Naze, Jarner found the sandstone lying directly over the gneiss. Of the fossils from here only *Macrodon Mylii* and *M. Hagenii* unfortunately are known, both of them new species which give no information regarding the age of the sandstone. We can hardly go wrong in concluding, however, that this sandstone must also be referred to the Séquanian-Kimmeridgian. South of the southern Gneiss Naze we have the southernmost sandstone region. As already mentioned above, the sandstone here has a different character and its fauna shows, that it belongs to the Callovian.

4. Hochstetter's Foreland. I have already mentioned, that the 2nd German North Pole Expedition found here extensive deposits of a yellowish, sometimes brick-red sandstone, which contained numerous, unfortunately badly preserved fossils, from which Toula and Fuchs were of opinion, that these deposits belonged to the Tertiary. The fossils brought home by the Danmark Expedition from this sandstone show, however, that we have to do with Jurassic deposits. We have first and foremost the occurrence of *Cardioceras alternans*, by which the age of the sandstone is determined to the Séquanian-Kimmeridgian. Of other fossils (see fauna list) may be noticed

Pecten Broenlundi and *Tancredia Jarneri*; both of these species as well as the other species determinable with a fair amount of certainty are known from the northernmost sandstone region on Store Koldewey. There can thus be no doubt, that the yellow and red sandstones on Hochstetter's Foreland and the gray sandstone farthest to the north on Store Koldewey belong to the same age.

c. **Portlandian.**

In the district round Danmarks Havn, especially in the pass (Vesterdalen) which separates the so-called Harefjæld from the remaining part of the district, a number of sedimentary boulders were found which must have been brought down by the land-ice at a time, when the latter had a much greater extension than it has now. Where these boulders come from, is not known, as no trace whatsoever of fixed sedimentary masses has been found in the immediate neighbourhood. They have presumably been brought down from the north, as the ice seems to have come from this quarter, and it is possible, that a portion of them has come from the sedimentary deposits at Jøkel Bay, which contain a quantity of badly preserved fossil plants, whose age still remains undecided. The boulders proved to be very different, both as regards their petrographic character and their fossil contents; we can distinguish between sandstones containing mainly Portlandian fossils and calcareous concretions with the remains of a Neocom fauna. The former greatly resemble in appearance the sandstone from the northernmost of the 3 sandstone regions on Store Koldewey Island, as they are gray in colour and contain a quantity of calcium-carbonate and numerous flakes of mica. But the fauna is quite different. As the fauna list shows, *Dentalium nodulosum* is the only species, which is common to these boulders and the Alternans-strata on Store Koldewey. Of much more importance, however, is the occurrence of *Aucella tenuistriata* Lah. and *A. mosquensis* v. Buch, the first of which goes from the Séquanian to the Lower Portland, whilst the last-mentioned may well be considered as a species characteristic of the Portland. In any case a portion of these boulders must therefore be referred to the Portlandian. But we also find here a by no means small number of specimens of an *Aucella*, which seems to be very nearly related to *A. reticulata*, a species found on Spitzbergen in deposits, which according to Pompeckj must be referred to the Séquanian-Kimmeridgian, thus in layers which are of the same age as the Alternans-strata on Store Koldewey and on Hochstetter's Foreland. It is probable, therefore, that a portion of the boulders mentioned come from Alternans-strata, which

have perhaps been quite removed by an earlier land-ice with greater extension that the present.

d. Neocomian.

1. In addition to the boulders of sandstone just mentioned, boulders of quite a different character were also found in the district round Danmarks Havn, namely, calcareous concretions. These boulders seem to be comparatively rare, only 4 being found. They consist of a coal-black, clayey limestone with few flakes of mica. Their origin is unknown; it is possible perhaps, that they may have come from some sediments, which occur farther north at Jøkel Bay and consist mainly of black, slaty clay; but this is very doubtful, as such concretions — so far as I am aware — have not been found in these sediments. One of the concretions contained only an Ammonite, *Lytoceras polare n. sp.*, whilst two others were very rich in fossils, which however could only be prepared with great difficulty. The most common forms are *Garnieria pusilla n. sp.* and two species of *Aporrhais*. From the occurrence of a representative of the genus

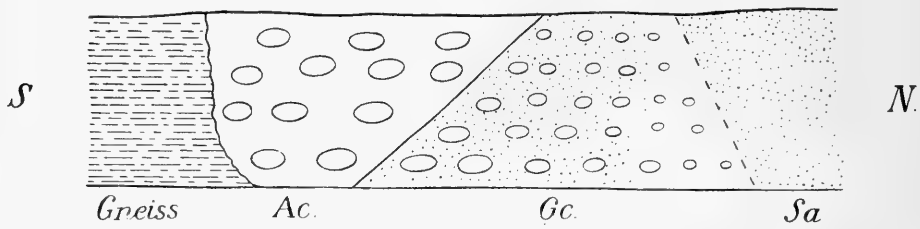


Fig. 1. Diagrammatic sketch of "Aucellabjerget" (H. Jarner). Ac. = "Aucella-conglomerate". Gc. = "Gneiss-conglomerate". Sa. = Sandstone.

Garnieria we may perhaps conclude, that these concretions come from deposits belonging to the Neocomian. Some young specimens of an *Aucella* found in these concretions seem to point in the same direction. These cannot be determined as to species, it is true, but so much seems certain, that they belong to a Neocomian type.

2. "Aucellabjerget". This locality lies at the south end of the southernmost of the sandstone regions on the east side of Store Koldewey Island. On a short stretch here Jarner found conglomerates of a very characteristic appearance. Both towards the north and the south the boundary of the conglomerates was fairly indistinct. Farthest to the north (thus nearest the sandstone) the conglomerate consisted of fragments of gneiss, between which a reddish limestone has been deposited. Further to the south the gneiss fragments became larger, from the size of a fist to that of the head; their interspaces were filled with a reddish sandstone, which macroscopically

at any rate greatly resembled the sandstone found down from "Trækpasset" and mentioned above (p. 441). This conglomerate is called "gneiss-conglomerate" in the sequel. After this followed a conglomerate of quite a different appearance. It consisted likewise of gneiss boulders, often larger than a man; the interspaces were here filled with a light-yellow or reddish-brown limestone, which was formed to a very great extent of shells of Aucellae; the reddish sandstone was likewise found in this conglomerate. In the following this conglomerate is called the "Aucella-conglomerate". Towards the south the conglomerate was bounded by gneiss. The two conglomerates mentioned were very different in appearance, when seen from a distance, but near at hand they seemed to grade into one another. In the section the boundary line between them formed an angle of ca. 45° with the horizontal line, the "gneiss conglomerate" being partly covered over by the "Aucella-conglomerate". The strike and dip of the boundary plane could not be determined.

No fossils were found in the "gneiss-conglomerate". On the other hand, fossils were very abundant in the "Aucella-conglomerate", as the limestone between the gneiss blocks was formed almost exclusively of shells of *Aucella concentrica, A. crassicollis* and *A. piriformis,* which evidently occur here in enormous quantities. These 3 species, according to PAVLOW, are characteristic of the zone with *Polyptychites polyptychus,* and the "Aucella-conglomerate" thus belongs to the Neocomian.

How are we to explain this section? The most natural view seems to me the following. The gneiss-conglomerate belongs to the sandstone and indicates the transgression of the latter over the gneiss. That this seems to be the explanation would appear from the facts, (1) that there is no distinct boundary between the sandstone and conglomerate; (2) that the size of the gneiss fragments increases towards the south (thus in the direction away from the sandstone); and (3), that the interspaces between the gneiss fragments are filled with a sandstone, which macroscopically at least resembles the sandstone farther north. As the latter belongs to the Callovian, we thus find here a transgression of Callovian age. Unfortunately, no trace of fossils could be found in this conglomerate, from which its age might have been determined.

The Aucella-conglomerate is much younger than the gneiss-conglomerate, as it certainly belongs to the Neocomian, as mentioned above; it also has quite a different character. Like the gneiss-conglomerate it consists for a very great part of gneiss fragments, it is true, but the interspaces between these are filled with *Aucella* shells. Here also the reddish sandstone occurs, but — I expect — only as

fragments. This is undoubted evidence of a transgression of the Neocomian Sea. It is somewhat difficult to decide, on which deposits this Sea at that place has exercised its destructive action. Perhaps it has been both the gneiss and a Callovian sandstone, but it seems to me more probable, that it has just been the gneiss-conglomerate, which has been at that time exposed to erosion. Both the gneiss and sandstone fragments may have come from this. And just the fact, that the gneiss fragments in the Aucella-conglomerate reached a larger size than in the gneiss conglomerate, seems to me to point in favour of the same thing and in the gneiss conglomerate these fragments were larger towards the south in the direction of the Aucella conglomerate.

2. Palæogeographical remarks.

Deposits belonging to the Callovian were only found at one locality by the Danmark Expedition, namely on the east coast of Store Koldewey Island down from "Trækpasset". Unfortunately, only a small number of fossils were found here. Of the 8 species which could be determined, at least the half seem to be undescribed, and not one of them is known from the deposits of the same age on Jameson's Land. This is very remarkable, but it is doubtful if we are entitled to draw conclusions from it with regard to the distribution of sea and land in these regions in the Callovian period. To judge from the fauna, however, so much seems certain, that a connection has existed at that time ("Shetland Strait", Neumayr) between the "Arctic" Sea as it was then and the Sea which at that time covered parts of West and Middle Europe. The existence of this connection has already been suggested by other observers.

Whilst the fauna in the North-East Greenland Callovian thus clearly points towards the south, to West and Middle Europe, the fauna in the Séquanian-Kimmeridgian seems just as distinctly to point towards the east and south-east, to Spitzbergen, Nova Zembla and the Russian Jurassic. The agreement with the fauna in the Alternans-deposits of these countries is so great, that there can be no doubt, that a wide sea has extended in the Séquanian-Kimmeridgian period from Central and North Russia up over Nova Zembla and Spitzbergen to the coast of North-East Greenland. All the 3 *Aucella* species found in the Alternans-deposits in North-East Greenland (*A. kirghisensis*, *A. Bronni* and *A. Sinzovi*) have undoubtedly come from the east and south-east and the same is the case with all the Cephalopods (*Cardioceras alternans* and *C. Nathorsti*, as also *Belemnites Panderianus* and *B. breviaxis*). A number of the other species point also in the same direction, whilst others seem to in-

dicate a connection with the English and Middle European Jurassic. These last are, however, all more or less indifferent forms (species of the genera *Tancredia*, *Astarte*, *Chemnitzia*), on whose occurrence we can scarcely lay very much weight; to my mind they are unable to prove the existence of a "Shetland Strait" at that time. If such had existed, the Cephalopod fauna, for example, would also have contained West and Middle European forms as well as the Russian-Arctic. That hitherto unknown forms occur as well as earlier known and described species, is not so surprising, as we are here dealing with a region which is far removed from all the others, where deposits of this time have been found.

As mentioned, the Alternans-strata have been found at two places, on Store Koldewey Island and on Hochstetter's Foreland. Some samples of the sandstone from Store Koldewey contain pieces of gneiss, which shows, that the Séquanian-Kimmeridgian Sea has extended in over a gneiss region. A direct deposition of sandstone on gneiss has been observed by Jarner only in the middle sandstone region, which as already mentioned also belongs to the Alternans-strata in all probability. The conditions on Hochstetter's Foreland are not known with certainty. There is some reason to believe, however, that the sandstone here also rests on gneiss, as the sandstone region — so far as known — borders directly on the gneiss and we do not know of any dislocations between sandstone and gneiss.

The next stage represented in the material brought home by the Danmark Expedition, is the Portlandian. This stage was only found, however, as boulders in the surroundings of Danmarks Havn. These boulders probably come from deposits, which are of the same age as the sandstone at the Aucella River on Jameson's Land, which is referred by V. Madsen to Middle Portlandian. The discovery of *Aucella tenuistriata* in the boulders, however, indicates Lower Portlandian, so that both the Lower and Middle Portlandian are possibly represented.

Along with these boulders, as already mentioned, 4 boulders of quite a different character and fauna were found, namely, black calcareous concretions with a species of the genus *Garnieria*, which shows that these belong to the Neocomian. These concretions probably come from deposits which were laid down in much deeper water than all the Jurassic sediments mentioned in the foregoing. In this also they form a contrast to the other Neocomian deposits known from North-East Greenland, namely, the "Aucella-conglomerate" from Aucellabjerget on the east coast of Store Koldewey Island, which must be considered as a pure strand-formation. The

Neocomian beds discovered by the 2nd German North Pole Expedition on the east side of Kuhn's Island must also be regarded as deposits from shallow water. As already indicated above, the conditions at Aucellabjerget show, that we have here a Neocomian transgression, and it appears distinctly from the fauna, that this overflowing sea must have been in communication with the Russian Neocomian Sea.

A tabular summary is given below of all the known, mesozoic deposits on the east coast of Greenland, the age of which has been determined. As will be seen, there are still various lacunae to fill up and questions to solve, even though it may be said, that the Danmark Expedition has made considerable contributions to our knowledge of the mesozoic formations on this portion of the globe.

Neocomian	Boulders at Danmarks Havn. East coast of Kuhn's Island. Aucellabjerget on Store Koldewey Island.
Middle Portlandian (& Lower Portl.)	Boulders at Danmarks Havn. Aucella River on Jameson's Land.
Séquanian-Kimmeridgian	"Kløft I", "Kløft II" and "4. Sænkning" on Store Koldewey Island. Hochstetter's Foreland.
Callovian	Down from "Trækpasset" on Store Koldewey Island. ? South coast of Kuhn's Island. Cape Stewart, Dinosaurus River, Ammonite Mountain } Jameson's Land. . . . . "Vardekløft" on Jameson's Land.
Lower Bathonian or Upper Bajocian	Mount Nathorst on Jameson's Land.
Rhaetian-Liassic	Deposits with plants at Cape Stewart.

3. List of the fauna.

	Vesterdalen	Harefjæld	Danmarks Havn	"Kloft I"	"Kloft II"	"4. Sænkning"	Middle sandstone region	Down from "Trækpasset"	Aucellabjerget	Hochstetter's Foreland
1. *Pentagonaster* (?) sp.	..	..	..	..	..	+	..	..	..	..
2. *Serpula cfr. convoluta* Goldf.	..	..	..	..	..	+	..	..	..	..
3. — sp.	..	..	..	..	..	..	..	+	..	..
4. *Rhynchonella* sp.	..	..	..	+	..	..	..	..	..	..
5. *Terebratula* sp.	..	..	..	+	..	..	..	..	..	..
6. *Oxytoma inaequivalvis* Sow., *var. macroptera* Roem.	..	..	..	..	..	..	..	+	..	..
7. *Oxytoma inaequivalvis* Sow., *var. Münsteri* Bronn.	+	..	..	..	..	..	..	..	..	..
8. *Pseudomonotis* (?) sp.	+	..	..	..	..	..	..	..	..	..
9. *Aucella kirghisensis* Sok.	..	..	..	+	..	..	..	..	..	..
10. — *Bronni* Lah.	..	..	..	+	+	+	..	..	..	..
11. — *Sinzovi* Pavl.	..	..	..	+	+	+	..	..	..	..
12. — *cfr. reticulata* Lundgr.	+	..	+	..	..	..	..	..	..	..
13. — *mosquensis* v. Buch.	..	+	..	?	..	..	..	..	..	..
14. — *tenuistriata* Lah.	+	..	..	..	..	..	..	..	..	..
15. — *crassicollis* Keys.	..	..	..	..	..	..	..	..	+	..
16. — sp.	..	..	..	..	..	..	..	..	+	..
17. — *piriformis* Pavl.	..	..	..	..	..	..	..	..	+	..
18. — *concentrica* Fisch.	..	..	..	..	..	..	..	..	+	..
19. *Posidonomya ornati* Quenst. sp.	..	..	..	..	..	..	..	+	..	..
20. *Pinna* sp.	+	..	..	..	..	..	..	..	..	..
21. *Perna groenlandica* n. sp.	..	..	..	+	..	..	..	..	..	..
22. *Gervilleia* sp.	..	..	..	..	..	+	..	..	..	..
23. *Pecten* (*Entolium*) *demissus* Bean.	..	+	..	..	..	..	..	..	..	..
24. — — *cingulatus* Phill.	..	..	..	..	..	..	..	+	..	..
25. — — *erraticus* Fieb. ?	+	+	..	..	..	..	..	..	..	..
26. — (*Camptonectes*) *Broenlundi* n. sp.	?	..	..	+	.	..	..	..	..	?
27. — — sp.	..	..	..	..	+	..	..	..	..	..
28. — — sp.	..	+	..	..	..	..	..	..	..	..
29. *Ostrea* sp.	..	..	..	+	..	+	..	..	..	+
30. *Modiola Strajeskiana* d'Orb. sp.	..	..	..	+	+	..	..	..	..	+
31. — sp.	+	..	..	..	..	..	..	..	..	..
32. — *hannoverana* Struckm. ?	..	..	..	+	..	..	..	..	..	..
33. *Yoldia* sp.	+	..	..	..	..	..	..	..	..	..
34. *Macrodon Keyserlingii* d'Orb. sp.	..	..	..	..	+	?	..	..	..	..
35. — *Schourovskii* Rouil. sp.	+	..	..	..	..	..	..	..	..	..
36. — *Mylii* n. sp.	..	..	..	..	..	..	+	..	..	..
37. — *Hagenii* n. sp.	..	..	..	..	..	..	+	..	..	..
38. *Astarte striato-costata* Mü.	..	..	..	+	..	..	..	..	..	..
39. — *minima* Phill.	..	..	..	+	..	+	..	..	..	..
40. — *alta n.* sp.	..	..	..	+	..	..	..	..	..	..
41. "*Astarte*" *retrotracta* Rouil.	..	..	..	..	..	+	..	..	..	..

	Vesterdalen	Harefjæld	Danmarks Havn	"Kløft I"	"Kløft II"	"4. Sænkning"	Middle sandstone region	Down from "Trækpasset"	Aucellabjerget	Hochstetter's Foreland
42. *Tancredia curtansata* Phill. sp.						+				
43. — *planata* Morr. & Lyc.				+		+				
44. — *axiniformis* Phill. sp.				+		+				+
45. — *Jarneri* n. sp.					+	+				+
46. *Lucina substriata* Roem. ?					+	?				
47. *Protocardia* sp.				+		+				
48. *Cyprina* cfr. *mosquensis* d'Orb.				+						
49. — *Sharoschovensis* Rouil.				+		+				+
50. — *Syssollae* Keys.				+		+				+
51. — cfr. *inconspicua* Lindstr.				+		+				
52. — *Panderi* Rouil. sp. ?				+						
53. *Pleuromya peregrina* d'Orb. sp.				+		+				
54. *Goniomya* sp.										+
55. *Dentalium nodulosum* Lundgr.	+			+		+				
56. *Amberleya groenlandica* n. sp.								+		
57. — *Jasicofiana* d'Orb. sp.?						+				
58. *Natica* sp.				+		+				
59. *Turritella* sp.		+		+	+					
60. *Chemnitzia undulata* Tullb. sp.				+		+				
61. — *hamptonensis* Morr. & Lyc.				+		+				
62. *Aporrhais* sp.			+							
63. — sp.			+							
64. *Lytoceras polare* n. sp.	+									
65. *Cardioceras alternans* v. Buch.				+		+				+
66. — *Nathorsti* Lundgr. sp.				?	+	?				
67. — sp.				+						
68. *Quenstedtoceras* (?) sp.								+		
69. *Cosmoceras boreale* n. sp.								+		
70. *Kepplerites Tychonis* n. sp.								+		
71. *Aulacostephanus* (?) *groenlandicus* n. sp.					+					
72. *Garnieria pusilla* n. sp.	+		+							
73. *Belemnites Panderianus* d'Orb.				+						
74. — *breviaxis* Pavl.				+						

IV. Description of the fossils.

1. **Pentagonaster** (?) sp.

A single marginal plate of an Asteroid, which seems to belong to the genus *Pentagonaster* LINCH, was found in one of the free-lying stones at "4. Sænkning" on Store Koldewey Island. The material is too imperfect for a closer determination.

2. **Serpula cf. convoluta** GOLDFUSS.

1831. *Serpula convoluta* GOLDFUSS, Petref. Germ., Vol. I, p. 228; Pl. 67, fig. 14.

Cylindrical, thick-walled, spirally twisted tube with transverse wrinkles on surface; only the older whorls attached to the understratum.

Of the two available specimens, one is twisted to the right, the other to the left. They are distinguished from GOLDFUSS' species, which was found in the Dogger, by the absence of a sharply marked spiral ridge; further, they seem to be considerably thicker in the shell, so that they possibly cannot be referred to this species, with which however they show fairly great agreement.

Distribution. North-East Greenland: Store Koldewey Island, lying loose on the tenting ground, 2—6. June 1907 (1 spec.); Store Koldewey Island, exact locality not stated (1 spec.).

3. **Serpula** sp.

Attached to a specimen of *Amberleya groenlandica* n. sp. in a loose-lying stone, from the locality down from "Trækpasset" on Store Koldewey Island, was the hind part of a *Serpula* tube triangular in section. Closer determination was impossible.

4. **Rhynchonella** sp.

Two valves belonging to one or other species of the genus *Rhynchonella* are so defective, that even an approximately certain determination of the species is impossible. They have few, but well-marked radial folds and a narrow and deep sinus. Both were found at "Kløft I" on Store Koldewey Island.

5. **Terebratula** sp.

Some specimens of a fairly large *Terebratula* species could unfortunately not be prepared entirely free from the rock, so that the species could not be determined. They all come from "Kløft I" on Store Koldewey Island.

6. **Oxytoma inaequivalvis** Sowerby, var. **macroptera** Roemer.

Pl. XXXII, fig. 1.

1835. *Avicula macroptera* F. A. Roemer, Verstein. d. norddeutsch. Oolithen Gebirges, p. 86; Pl. 4, fig. 5.

1902. *Oxytoma inaequivalve* Sow., var. *macroptera* Roem.; L. Waagen, Der Formenkreis des *Oxyt. inaequiv.* Sowerby, p. 14; Pl. 1. figs. 7 and 14.

Only the mould of the hindmost part of a left valve.

The shell strongly arched with up to 10 rounded, primary radial ribs, with intermediate secondary ribs, which reach the same size as the primary a little below the beak. Further, on the younger parts of the shell finer tertiary ribs and on the very youngest a further system of quite fine ribs, all in perfectly regular series. On the very hindmost part of the valve only uniform, fairly fine ribs, a sculpture repeated on the large, deeply emarginated wing which is not sharply marked off from the rest of the valve.

The available specimen must undoubtedly be referred to *O. inaequivalvis* Sow. in spite of its incompleteness, and according to Waagen's description and figures it seems quite clearly to belong to his var. *macroptera* Roem.

Distribution. North-East Greenland: Down from "Trækpasset" on Store Koldewey Island, in a loose-lying stone, 50 m. above the sea.

North Germany: in the Hils deposits.

7. **Oxytoma inaequivalvis** Sowerby, var. **Münsteri** Bronn.

1829. *Avicula Münsteri* Bronn in Leonhard: Zeitschr. f. Mineralogie, 1829, p. 76.

1836. — — — ; Goldfuss, Petref. Germ., Vol. II; p. 131; Pl. 118, fig. 2.

1902. *Oxytoma inaequivalve* Sow., var. *Münsteri* Bronn; Waagen, Der Formenkreis des *Oxyt. inaequiv.* Sowerby, p. 13; Pl. 1, figs. 9 and 11.

For the remaining synonymy reference may be made to the above-cited work of Waagen.

A few left valves of this variety are present, unfortunately so badly preserved that a complete description cannot be given.

The valve very oblique, strongly arched, covered with a large number of radial ribs of almost the same size. The posterior wing large, distinctly marked off from the rest of the valve.

Distribution. North-East Greenland: North side of Vesterdalen at Danmarks Havn (1 spec.); south side of Vesterdalen (2 spec.).

Europe: in Liassic—Malm (cf. Waagen, l. c.).

8. **Pseudomonotis** (?) sp.

A single valve found in a boulder on the south side of Vesterdalen at Danmarks Havn, which seems to belong to one or other species of the genus *Pseudomonotis*.

The valve almost symmetrical and somewhat arched. Its surface covered with numerous radial ribs, which seem to vary somewhat in size and have possibly borne small, short spines or teeth.

In other boulders from Vesterdalen are some fragments of valves, of which only the inner side can be seen; these have also had ribs, alternately finer and coarser. How far these valves belong to the same species as the above, cannot be determined.

9. **Aucella kirghisensis** Sokolow.

Pl. XXXII, fig. 2.

1903. *Aucella kirghisensis* Sokolow, Aucellen aus Ost-Russland, p. 374; Pl. 14, figs. 1-5.
1907. — — — ; Pavlow, Enchaînement etc., p. 13; Pl. 2, figs. 18—19.
1908. — — — ; Sokolow, Aucellen vom Timan und von Spitzbergen, p. 10; Pl. 1, figs. 12—14.

Some fairly perfect casts agree exceedingly well with the above-cited descriptions and figures.

The form of the shell oblong-oval, somewhat oblique. The left valve strongly inflated, right valve somewhat less so. The beak comparatively little prominent. Ear indistinct. Surface of the casts covered with little prominent, concentric lines of growth and still more indistinct radial ribs.

The length[1] of the left valve figured is ca. 22 mm, its breadth ca. 16 mm and its thickness 6 mm; the angle at the beak is ca. 95°.

Distribution. North-East Greenland: "Kløft I" on Store Koldewey Island (5 spec.).

Russia: in deposits with *Cardioceras alternans*.

10. **Aucella Bronni** Lahusen.

Pl. XXXII, fig. 5.

1888. *Aucella Bronni* Rouill.; Lahusen, Ueber die russischen Aucellen, p. 32; Pl. I, figs. 1—7.
1901. — — — ; Pompeckj, Aucellen im Fränkischen Jura, p. 24; Pl. 4, fig. 4.
1907. — — Lahus.; Pavlow, Enchaînement etc., p. 14; Pl. 1, fig. 31.

The left valve oblong-oval, very oblique, somewhat strongly arched, flatter towards the posterior margin. The beak comparatively small and little prominent, curved inwards. The anterior margin and ventral margin forming a flat curve; the posterior margin slightly concave, almost straight. Surface of the cast covered with numerous, distinct, concentric folds and with numerous, fine, less distinct radial

[1] The method used in measuring this and the following *Aucella* species is that of Pavlow (l. c., p. 10—11).

lines. — The right valve somewhat less arched, but otherwise in the main with the same circumference and the same sculpture.

A left valve has the following dimensions: length 41 mm, breadth 26 mm and thickness ca. 9 mm; the angle at the beak 70°. — The largest specimen has a length of 59 mm.

Distribution. North-East Greenland: "Kløft I" (1 spec.), "Kløft II" (at least 4 spec.) and in loose-lying stone at "4. Sænkning" (1 spec.) on Store Koldewey Island.

Russia: in deposits with *Cardioceras alternans.*

Germany: in Kimmeridgian deposits in Franconia.

Mexico: ?

11. **Aucella Sinzovi** A. P. Pavlow.

Pl. XXXII, fig. 3.

1881. *Aucella mosquensis* Tullberg, Verst. Aucellen-Schichten Novaja-Semljas, p. 22; Pl. 2, figs. 16—18.
1907. — *Sinzovi* Pavlow, Enchaînement etc., p. 17; Pl. I, fig. 12.

A number of more or less perfect casts of an *Aucella* must certainly be referred to this species.

The shell very oblique, oblong-oval. The left valve fairly strongly arched. The beak on both valves small, little prominent and curved inwards. The surface with irregular interspaces covered with stronger and fainter, concentric folds, and with more regular, distinct, somewhat undulating radial striae.

Left valve: length 21 mm, breadth 14·5 mm and thickness 8·5 mm; angle at the beak ca. 95°.

The available specimens agree well with Tullberg's original specimens, which I have seen in the Riksmuseum in Stockholm. They likewise seem to be in perfect agreement with Pavlow's description and figures of specimens from Khanski.

A single right valve resembles greatly in form *A. solodurensis* de Lor., but is probably nothing else but a compressed (and thus probably very broad) valve of the species above.

Distribution. North-East Greenland: "Kløft I" (7 spec.), "Kløft II" (3 spec.) and in free-lying stones at "4. Sænkning" (5 spec.) on Store Koldewey Island.

Nova Zembla: in deposits with *Cardioceras alternans.*

Russia: in deposits with *A. Bronni.*

12. **Aucella cf. reticulata** Lundgren.

Pl. XXXII, fig. 4.

1883. *Aucella reticulata* Lundgren, Jura- und Trias-Fossilien von Spitzbergen, p. 16; Pl. I, figs. 6—7.
1907. — — — ; Pavlow, Enchaînement etc., p. 18.

Some specimens of an *Aucella* seem — to judge especially from their characteristic sculpture — to be nearly related to *A. reticulata*. A cast with a small portion of the shell preserved forms the basis of the following description.

Circumference short-oval. Left valve strongly arched; beak strongly bent backwards; anterior margin forming an even curve with the ventral margin; posterior margin long and straight, meeting the very convex ventral margin in a sharp bend. Right valve only slightly arched, most strongly in the direction from the front to the hind margin. Both valves covered with very prominent, concentric lines, crossed by equally strong radial lines; no distinct knots at the points of crossing.

Left valve: length ca. 21 mm, breadth 19 mm and thickness 7 mm; angle at the beak ca. 80°.

In the Riksmuseum of Stockholm I have compared the available specimens with LUNDGREN's originals, from which they differ in two points, their length is not so great and the left valves are considerably more arched. As LUNDGREN noted, his original specimens were compressed, so that the disagreement in form is possibly only apparent.

A. reticulata is stated by LUNDGREN to have been found on Spitzbergen along with *A. radiata* and *A. spitzbergensis* (= *A. Bronni* ?).

Distribution. North-East Greenland: in boulders on the south side of Vesterdalen at Danmarks Havn (4 spec., 2 of them connected). In boulders at Danmarks Havn (6 spec.).

13. **Aucella mosquensis** v. BUCH sp. (non KEYSERLING, non LAHUSEN).
Pl. XXXII, fig. 6.

1844. *Avicula mosquensis* v. BUCH, Neue Verst. aus Moskau, p. 537; Pl. 6, fig. 1.
1846. *Aucella Pallasii* KEYSERLING, Petschora-Land, p. 299; Pl. 16, figs. 1—6.
1848. *Buchia* — — ; ROUILLIER, Études progr. Géol. Moscou, II, p. 272; Pl. D (Bull. Soc. naturalistes Moscou 1846), fig. 3.
1866. *Aucella mosquensis* v. BUCH var.; LINDSTRÖM, Trias- och Juraförsteningar från Spetsbergen, p. 14; Pl. 3, fig. 3.
1888. — *Pallasii* KEYS.; LAHUSEN, Ueber die russischen Aucellen, p. 34; Pl. 1, figs. 12—20.
1904. — — — ; MADSEN, Jurassic Fossils from East-Greenland, p. 178; Pl. 6, fig. 7.
1907. — *mosquensis* BUCH (non KEYS., non LAHUS.); PAVLOW, Enchaînement etc., p. 22; Pl. 2, figs. 5—8.

Of this species only the casts of a couple of left valves were found.

The left valve with ovoid circumference, somewhat strongly arched, very oblique. The umbo inclined backward and at the same time far over the right valve; its outermost point bent a little for-

ward. Front margin of the valve very steep, the hind margin very flatly curved. Surface of the cast covered with fairly prominent, concentric folds; no trace of radial sculpture.

Left valve: length 30 mm, breadth 20 mm and thickness 8·5 mm. Angle at the beak ca. 65°.

Casts of two small (7—8 mm long) left valves of an *Aucella* were found at "Kløft II" on Store Koldewey Island; in these the umbo is pointed and inclined strongly inwards; the surface only has fairly well-marked, concentric folds. These are possibly young specimens of the above species.

Distribution. North-East Greenland: in boulders near Harefjæld at Danmarks Havn (2 spec.). "Kløft I" on Store Koldewey (2 spec. ?).

East Greenland: in Middle Portlandian at Aucella River on Jameson's Land.

Spitzbergen: in Portlandian.

King Charles Land: Kimmeridgian—Portlandian.

Russia: Portlandian.

England: Portlandian.

Alaska: Lower Portlandian.

Mexico: Pavlow notes the species from here with some reservation.

14. **Aucella tenuistriata** Lahusen.

Pl. XXXII, fig. 7.

1846. *Aucella Pallasii* var. *polita* Keyserling, Petschora-Land, p. 299; Pl. 16, fig. 7.
1888. — — Keys. var. *tenuistriata* Lahusen, Ueber die russischen Aucellen, p. 34; Pl. 1, figs. 25—27.
1901. — — — - — — ; Pompeckj, Aucellen im Fränkischen Jura, p. 25; Pl. 4, figs. 5—6.
1907. — *tenuistriata* Lahus. var.; Pavlow, Enchaînement etc., p. 33.

The left valve obliquely pyriform, fairly strongly arched, very oblique; umbo bent strongly backwards, concave in front, fairly flat above; the anterior and ventral margins together forming almost a semicircle; posterior margin somewhat concave. Surface of the cast covered with fine, concentric lines and of still finer radial striae, almost as in *A. Bronni*.

Left valve: length 30 mm, breadth 19 mm and thickness ca. 6 mm; angle at the umbo ca. 75°.

Along with this left valve was also a badly preserved right valve; it is almost completely flat and has the same sculpture as the left valve.

Distribution. North-East Greenland: in boulders on the

south side of Vesterdalen at Danmarks Havn (3 left valves and (?) 1 right valve).

Russia: Alternans deposits — Lower Portland.

Mexico: ?

15. **Aucella crassicollis** KEYSERLING.

Pl. XXXII, fig. 8.

1846. *Aucella crassicollis* KEYSERLING, Petschora-Land, p. 300; Pl. 16, figs. 9—12.
1874. — *concentrica* var. *rugosa* KEYS.; TOULA (*pars*), Kuhn-Insel, p. 503; Pl. 2, fig. 3.
1888. — *crassicollis* KEYS.; LAHUSEN, Ueber die russischen Aucellen, p. 42; Pl. 5, figs. 9—13.
1895. — — — ; STANTON, Knoxville beds, p. 45; Pl. 5, fig. 8 and Pl. 6, figs. 3—5.
1907. — — — ; PAVLOW, Enchaînement etc., p. 62; Pl. 5, fig. 16.

Left valve almost equilateral, usually however obliquely triangular, very high and strongly inflated, from about the middle narrowing very rapidly up towards the umbo; the uppermost half of the valve thus narrow and elongated; beak inclined somewhat forwards and strongly inwards. On the surface of the cast sometimes a single, very deep, concentric furrow; further, rather faint traces of concentric folds. — Along with the left valves some fragments of fairly flat, almost completely smooth right valves were found, which probably also belong to this species.

None of the specimens are so complete, that measurements can be given.

Distribution. North-East Greenland: in reddish brown limestone in Aucellabjerget on Store Koldewey Island along with *A. piriformis* (many spec.). — East Greenland: Kuhn Island (collected by the 2nd German North Pole Expedition).

Russia: in deposits belonging to the zone with *Polyptychites polyptychus*.

America: in Knoxville Beds in British Columbia and California.

16. **Aucella** sp.

Pl. XXXIII, fig. 1.

In a gray limestone in Aucellabjerget on Store Koldewey Island was found a single left valve of an *Aucella*, which does not seem to be referable to any of the species mentioned in this paper. It is elongated, fairly equilateral and evenly arched; the beak is inclined slightly forward; angle at the beak ca. 77°. As the specimen is not complete and there is only this one example, I do not venture to refer it to any of the above-described species; it belongs in any case, however, to the *Keyserlingi*-group.

17. **Aucella piriformis** Lahusen, emend. A. P. Pavlow.

Pl. XXXII, figs. 11 and 12.

1874. *Aucella concentrica* var. *rugosa* Keys.; Toula (*pars*), Kuhn-Insel, p. 503; Pl. 2, fig. 2.
1881. — *Keyserlingiana* Trautsch., *forma majuscula* Tullberg, Aucellen-Schichten Novaja-Semljas, p. 23; Pl. 2, figs. 9—12.
?1884. — *concentrica* Fisch. var.; White, On Mesozoic Fossils, p. 13; Pl. 6, figs. 6—7.
1888. — *sublaevis* (Keys.) Lahus.; Nikitin, Période crètacée Russie centrale, p. 74; Pl. 2, figs. 13—14.
1888. — *piriformis* Lahusen, Ueber die russischen Aucellen, p. 42; Pl. 5, figs. 3—7.
1900. — *Keyserlingi* Lah.; Wollemann, Bivalven u. Gastrop. des deutschen u. holländ. Neocoms, p. 56; Pl. 2, figs. 6—9.
1907. — *piriformis* Lahus.; Pavlow, Enchaînement etc., p. 63; Pl. 5, figs. 20—22.
1908. — *sublaevis* Keys.; Sokolow, Aucellen vom Timan etc., p. 22; Pl. 3, figs. 3—5.

A fairly large number of specimens of *A. piriformis* were found in a reddish brown limestone in Aucellabjerget on Store Koldewey Island along with *A. crassicollis.* The rock consists for the most part of more or less well-preserved *Aucella* shells; it further contains a number of fragments of gneiss, as also small flakes of white and black mica, garnet etc. Secondary are here and there secreted groups of calcite.

The left valve short, pyriform, rather oblique, strongly inflated, thickest about the middle; the beak short, curved inwards and somewhat forwards; the surface covered with regular, fairly sharp, concentric folds. — The right valve obliquely oviform, evenly but much less strongly arched than the left valve; its greatest thickness lying above the middle and from here lessening evenly towards the ventral margin; the beak pointed, somewhat prominent and inclined forwards; the surface like that of the left valve.

Right valve: length 38 mm, breadth 32 mm and thickness 16 mm; angle at the beak ca. 70°.

The specimens seem to agree exceedingly well with Toula's form from Kuhn Island.

Distribution. North-East Greenland: along with *A. crassicollis* in Aucellabjerget on Store Koldewey (many spec.). — Kuhn Island (2nd German North Pole Expedition).

Nova Zembla: in the *Aucella* deposits.

Russia: the species has a wide distribution in deposits belonging to the zone with *Polyptychites polyptychus.*

Germany: Neocomian beds.

Alaska (?): Neocomian beds.

18. **Aucella concentrica** FISCHER sp. (non KEYSERLING, non EICHWALD).

Pl. XXXII, figs. 9 and 10.

1830—37. *Inoceramus concentricus* FISCHER DE WALDHEIM, Oryctographie du Gouvernement de Moscou, p. 177; Pl. 20, figs. 1—3.

1888. *Aucella piriformis* LAHUSEN (*pars*), Ueber die russischen Aucellen, p. 42; Pl. 5, figs. 1—2.

1907. — *concentrica* FISCH.; PAVLOW, Enchaînement etc., p. 66; Pl. 5, figs. 27—28.

Numerous specimens of this species are present, all from Aucellabjerget, where they occur in a yellowish-white shell-breccia, which seems to be almost exclusively formed of larger and smaller specimens of this species.

Oviform, very oblique. The two valves very different. The left strongly inflated, slightly elongated behind; the margins at the beak almost straight, continuing evenly through the lateral margins into the almost semicircular ventral margin; the beak pointed, inclined strongly inwards and somewhat backwards. The right valve considerably less arched, almost circular, but a little oblique and with projecting and pointed beak, which is bent slightly forwards. — Surface of the casts in the neighbourhood of the beak smooth or with few, faint, concentric folds; further down towards the ventral margin well-developed, fairly sharp, concentric folds; the folds of the left valve finer and denser than those of the right.

The following measurements are of two valves from different shells:

	Left valve	Right valve
Length	ca. 45 mm.	ca. 33 mm.
Breadth	- 34 —	31 —
Thickness	18 —	8 —
Angle at umbo	ca. 80°.	ca. 95°.

The specimens agree well with PAVLOW's description and figures, among other things also in the fact, that smaller right valves have a more triangular outline.

Distribution. North-East Greenland: Aucellabjerget on Store Koldewey Island (very numerous specimens).

Russia: in the zone with *Polyptychites polyptychus.*

Germany: in Neocomian deposits.

A number of small specimens of an *Aucella* were found in 2 of the black calcareous concretions occurring as boulders in the neighbourhood of Danmarks Havn. They are unfortunately too small and imperfect for the species to be determined. They seem to show some resemblance however to *A. terebratuloides.*

19. **Posidonomya ornati** Quenstedt sp.

Pl. XXXIII, figs. 2 and 3.

1858. *Posidonia ornati* Quenstedt, Der Jura, p. 551; Pl. 72, fig. 29.
1883. *Posidonomya ornati* — ; Lahusen, Jurass. Bild. des Rjasanschen Gouv., p. 25; Pl. 2, fig. 8.
1895. — *Buchi* Roem.; Stremoouchow, *Posidonomya Buchi* Roem. des schistes de Balaclava, p. 391; Pl. 1, figs. 1—8.

The shell fairly small, oblique and oblong, slightly arched. The cardinal margin straight, very long. The beak pointed, but little projecting, curved slightly backwards. Surface covered with numerous regular, dense, concentric ribs.

None of the specimens are so complete, that measurements can be given.

Distribution. North-East Greenland: Down from "Trækpasset" on Store Koldewey Island in a loose-lying boulder, 50 m above the sea (numerous specimens).

Russia: in deposits belonging to the Bathonian and Callovian.

Germany: Callovian.

20. **Pinna** sp.

Fragments of a large *Pinna* species were found in boulders on the south side of Vesterdalen at Danmarks Havn. The available material is far too insufficient to permit of even an approximate determination of the species.

21. **Perna groenlandica** n. sp.

Pl. XXXIII, figs. 4 and 5.

The shell linguiform with pointed, but slightly curved, terminal umbo. Angle between cardinal and anterior margins ca. 70°. Cardinal margin straight. Anterior margin very slightly concave, almost straight, merging evenly into the ventral margin and this again into the posterior margin. The surface with broad, faint, concentric folds. The right valve but slightly, the left considerably arched, with the highest part lying nearest the anterior margin sloping evenly downwards towards the wing. The cardinal margin with 8—10 broad ligamentary grooves, separated by narrow interspaces.

Right valve: height (measured from point of umbo to furthest point of the ventral margin) 63 mm, greatest breadth (measured at right angles to height) 35 mm and the thickness ca. 5 mm. — A cast from a left valve measured: height 80 mm, breadth ca. 46 mm and thickness ca. 12 mm.

A small specimen (26 mm high and 16 mm broad) has most of both valves preserved; otherwise there is practically nothing but casts.

The shell described seems to have great resemblance with *P. lamellosa* LAHUS., which I only know however from LAHUSEN's description and figure [1]. It lacks however the regular, sharp lines of growth, has a straighter cardinal margin and seems to be less strongly arched. The *Perna* mentioned by LUNDGREN from Cape Stewart in East Greenland [2] is so badly preserved, that it is impossible to say with certainty, if it is identical with *P. groenlandica*; but this does not seem to be the case.

Distribution. North-East Greenland: "Kløft I" on Store Koldewey Island (15 valves, 6 of them connected in pairs).

22. Gervilleia sp.

A specimen of a small *Gervilleia* is so imperfect, that a certain determination of the species is impossible. The wing is comparatively large; the hinge seems to have many ligamentary grooves. The specimen was found in a loose-lying boulder at "4. Sænkning" on Store Koldewey Island.

23. Pecten (Entolium) demissus BEAN.

Pl. XXXIII, fig. 8.

(1829) 1835. *Pecten demissus* BEAN; PHILLIPS, Geology of Yorkshire, I. Pl. 6, fig. 5.
1836. *Pecten demissus* PHILL.; GOLDFUSS, Petref. Germ. II, p. 74; Pl. 99, fig. 2.
1854. — — — ; MORRIS and LYCETT, Mollusca from the Great Oolite. Part. III, p. 127; Pl. 14, fig. 7,
1858. — — — ; QUENSTEDT, Der Jura, p. 353, 381 and 553; Pl. 48, fig. 6 and Pl. 72, fig. 27.
1866. — — BEAN; LINDSTRÖM, Trias- och Juraförsteningar från Spetsbergen, p. 14; Pl. 3, figs. 9—10.
1869. — — PHILL.; BRAUNS, Der mittlere Jura, p. 270.
1881. — — — ; TULLBERG, Aucellen-Schichten Novaja-Semljas, p. 24.
?1883. — — BEAN; LAHUSEN, Jurass. Bild. des Rjasanschen Gouv., p. 24; Pl. 2, fig. 4.

Only a single specimen can be referred to this species.

The valve but slightly arched; circumference oval, very nearly circular. The angle at the umbo ca. 120°. The ears extending somewhat out over the cardinal margin, small; cardinal margin relatively short (ca. 1/3rd of the whole breadth of the valve). Both the wings with a blunt angle. Surface of the valve covered with fine, concentric striae.

Height 30 mm, breadth 27 mm; length of the cardinal margin 9 mm.

Distribution. North-East Greenland: in a boulder on the east side of Harefjæld at Danmarks Havn (1 spec.).

[1] LAHUSEN: Jurass. Bild. des Rjasanschen Gouv., p. 91; Pl. 2, fig. 9.
[2] B. LUNDGREN: Jurafossil från Kap Stewart i Ost-Grönland, p. 202.

? Spitzbergen: in deposits belonging, according to Pompeckj, to the "? Portlandian (-Lower Chalk)".

Nova Zembla: in the *Aucella* deposits.

Russia: Callovian.

Germany: Dogger (from the "Coronaten-Schichten" to the Parkinsonia zone).

England: Dogger—Lowermost Malm (from Lower Oolite to Coralline Oolite).

24. Pecten (Entolium) cingulatus Phillips.

Pl. XXXIII, fig. 7.

(1829) 1835. ***Pecten cingulatus*** Phillips, Geology of Yorkshire, I, Pl. 5, fig. 11.
1836. ***Pecten cingulatus*** Phillips; Goldfuss, Petref. Germ., II, p. 74; Pl. 99, fig. 3.

The valve oval, but little arched; the angle at the umbo ca. 90°; from each side of the umbo a narrow depression down along the sides, losing itself at about halfway down the valve. The ears small, with slightly blunt angles and somewhat rounded corners. The surface with fine, concentric rings of growth.

Height 21 mm, breadth 18 mm.

The species described resembles greatly the *Pecten* figured by Lahusen[1] as *P. demissus*, but its surface seems to have a different character. It is doubtful, whether a couple of valves from boulders found at Danmarks Havn on the south side of Vesterdalen can be referred to *P. cingulatus*, as the form of the ears cannot be seen. The same applies to a couple of specimens from the boulder with *Aucella mosquensis* from Harefjæld.

Distribution. North-East Greenland: in the reddish brown, loose-lying sandstone down from "Trækpasset" (50 m above the sea) on Store Koldewey Island (1 spec.).

Germany: Lias to Lowermost Malm.

England: Cornbrash (Upper Dogger).

25. Pecten (Entolium) erraticus Fiebelkorn ?

1893. ***Pecten (Entolium) erraticus*** Fiebelkorn, Geschiebe der oberen Juraformation, p. 400; Pl. 14, fig. 12.

Some specimens of a very flat *Pecten* seem from their whole form and their surface, covered with regular, concentric furrows, to be referable to this species. As the form of the ears could not, however, be seen on the available specimens, the determination is somewhat uncertain.

Pecten erraticus is given by Fiebelkorn as occurring in Pommerania in boulders, which he refers to the Middle Kimmeridgian.

[1] Lahusen, Die Fauna der Jurass. Bild. des Rjasanschen Gouv., Pl. 2, fig. 4.

Distribution. North-East Greenland: only found in boulders in the neighbourhood of Danmarks Havn, on the north side of Vesterdalen (2 spec.) and on the south side (3 spec.), also together with *Aucella mosquensis* at Harefjæld.

26. **Pecten (Camptonectes) Broenlundi** n. sp.

Pl. XXXIV, figs. 5 and 6.

Large, circular Bivalve with very unequal valves. Angle at the umbo ca. 120°.

Left valve strongly arched; ears fairly small, not reaching over the cardinal margin and not very sharply distinct from the rest of the valve; the outer corner of both ears forming a blunt angle.

Right valve almost perfectly flat; outer corner of its posterior ear almost a right angle; anterior ear not seen. — The surface of both valves with numerous fine and a few coarse lines of growth, and crossing these almost at right angles characteristic, somewhat undulating, fine, deepened lines, which are frequently interrupted especially by the stronger lines of growth. Under the lens other, very fine, depressed lines, usually cutting the first-named, radial lines at a very pointed angle. The sculpture stronger on the wings and in the neighbourhood of these, of a characteristic, papillose character.

Left valve: height 99 mm, breadth 97 mm and thickness ca. 18 mm; length of cardinal margin ca. 45 mm.

In the light-gray sandstone from the top of Muschelberg on Hochstetter's Foreland some imprints were found of a large *Pecten,* which from their whole form might well belong to the same species as the above; unfortunately, small crystals of quartz have been secreted on the imprints, so that it is impossible to determine the nature of the surface of the valves. Thus, a certain determination cannot be made. This applies also to a cast found in a boulder on the south side of Vesterdalen at Danmarks Havn. It seems, however, to be distinct from *P. Broenlundi*, having a somewhat broader outline, a more pointed umbo and unusually flat lateral portions. It is thus even more doubtful, if this specimen can be placed under this species.

The form described resembles somewhat *P. imperialis* Keys., both in form and especially sculpture. It is readily distinguished from this, however, among other characters, by both its valves (and especially the right valve) being considerably less arched; further, its cardinal margin is relatively much shorter. *P. Broenlundi* has greater resemblance to *P. validus* Lindstr., but its left valve is more strongly arched, and the front margin below the anterior ear of the right

valve has a somewhat different form, its concavity being considerably fainter than is the case in *P. validus*.

Distribution. North-East Greenland: "Kløft I" on Store Koldewey Island (9 spec.). — ? Top of Muschelberg on Hochstetter's Foreland (3 spec.). — ? In a boulder from the south side of Vesterdalen at Danmarks Havn (1 spec.).

27. **Pecten (Camptonectes)** sp.

From "Kløft II" on Store Koldewey Island we have 3 double-valved specimens and a single left valve of a *Pecten*, which does not seem referable to any species hitherto described.

The valve is circular in outline with but little prominent umbo, which bends strongly forwards. The left valve strongly inflated; the posterior ear small, almost rectangular; the anterior ear not visible; the adductor scar rounded-triangular; no sculpture apparent on the surface. The right valve quite flat; its cast with a broad and deep furrow from the umbo down to the middle of the anterior margin; a similar, but less deep furrow along the upper part of the posterior margin; the surface — at least near the ventral margin — with fine, dense, fairly regular, concentric lines, as also radial lines of a similar nature; the surface of the valve thus has a characteristic, papillose character, similar to that in *P. lens* Sow.

Left valve: height 87 mm, breadth 84 mm and thickness ca. 15 mm.

The species described, the casts of which — owing especially to their obliquity — resemble to a certain extent casts of an *Ostrea*, has some resemblance to *P. validus* Lindstr., from which however it is distinguished by its left valve being not a little more arched; further, the two folds, which run on the inner side of the right valve along respectively the anterior and posterior margin, are much more marked and longer than in *P. validus*. The specimens probably belong to a new species, related to *P. lens* Sow.

28. **Pecten (Camptonectes)** sp.

In the same boulder which contained *Pecten demissus* and which came from the east side of Harefjæld at Danmarks Havn, there was also a single, small valve of another *Pecten*. The sculpture of the valve shows, that it belongs to the subgenus *Camptonectes*. A closer determination is impossible, however, as the whole of the region near the cardinal margin is wanting.

In addition to the species of *Pecten* mentioned above, the Danmark Expedition has also brought home 3 others from the Jurassic deposits in North-East Greenland. One was found in "Kløft II" on Store Koldewey Island; it is a shell of medium size, somewhat arched and with smooth surface. — The second species is fairly strongly arched and has had somewhat coarse radial ribs; it was found in a boulder of coarse-grained, gray sandstone lying at a height of 45 m above the sea down from "Trækpasset" on Store Koldewey Island. Lastly, in the sandstone from the top of Muschelberg on Hochstetter's Foreland a fragment was found of a cast of a left valve; the form of the ears shows, that this valve belongs to a species different from those described in the foregoing.

The imperfect state of preservation of all these shells prevents an exact determination.

29. **Ostrea** sp.

A few, more or less incomplete shells of an *Ostrea* of but little characteristic form were found at "Kløft I" on Store Koldewey Island. A couple of them seem partially to agree with *O. kharoschovensis* Rouill., but the imperfect material does not permit of a certain determination. The same applies to fragments of an *Ostrea* shell from "4. Sænkning" on Store Koldewey Island.

From the sandstone from the top of Muschelberg on Hochstetter's Foreland there is a cast of a single, large *Ostrea* valve. — Here also the species cannot be determined.

Probably these *Ostrea* fragments represent several species.

30. **Modiola Strajeskiana** d'Orbigny sp.

Pl. XXXIII, fig. 9.

1845. *Mytilus Strajeskianus* d'Orbigny in Murch., Verneuil et Keys., Géol. de la Russie d'Europe, II, 3., p. 463; Pl. 39, figs. 22—23.

A portion of a left valve, of which however only the inner side is to be seen, and the whole of the cast belonging to it seems referable to this species.

Elongated oval, considerably arched with a rounded ridge from the beak to the posterior end. The umbo somewhat behind the anterior end, but little prominent. The cardinal margin slightly curved, passing evenly over into the posterior margin; ventral margin straight. Surface with concentric lines of growth and — in the region above the ridge — with numerous fine radial striae. A furrow on the cast along the cardinal margin.

Height of cast 34 mm, length 82 mm and thickness 24 mm.

The only difference apparent between the specimen described and d'Orbigny's species is, that the posterior end in the Greenland form is somewhat less blunt and a little narrower; the result of the latter is that the cardinal margin is more curved. As there seems to be complete agreement otherwise, I do not think that there is reason for hesitating to refer this specimen to the species mentioned, especially as 3 other (less well-preserved) specimens agree in this regard with d'Orbigny's description and figures.

Distribution. North-East Greenland: "Kløft I" (3 spec.) and "Kløft II" (1 spec.) on Store Koldewey Island. — Top of Muschelberg on Hochstetter's Foreland (1 spec.). — ? Kuhn Island (2. German North Pole Expedition).

Russia: North Urals in Oxfordian.

31. **Modiola** sp.

In boulders from the south side of Vesterdalen at Danmarks Havn a couple of specimens were found of a *Modiola*, which belongs perhaps to a hitherto undescribed species. The material is however too incomplete to permit of a quite certain determination.

The best preserved valve is 30—35 mm long, but little arched, narrow in front and considerably broader behind. The umbo small, lying near the front end. A ridge fairly sharp at first, then more rounded, runs from the umbo obliquely downwards towards the lowermost part of the ventral margin. The surface with comparatively coarse, concentric lines.

The present form greatly resembles *M. Lonsdalei*, but is not nearly so much arched as the latter. It is probable, however, that it has originally been somewhat more arched than now, as its flatness is at least in part due to compression.

32. **Modiola hannoverana** Struckmann ?

1878. *Modiola hannoverana* Struckmann, Ob. Jura Hannover, p. 84; Pl. 2, fig. 1.
1906. — — — ; Borissjak, Pelecypoden der Jura-Ablagerungen im europ. Russland, III, p. 9; Pl. 2, figs. 1—4.

A couple of specimens of a *Modiola* greatly resemble this species, but they are so incomplete, that a certain determination is impossible.

Shell rather inflated; beaks nearly terminal, triangular-oval, narrowing towards the ventral margin; cardinal margin long and straight; the region in front of the umbo very short, separated from the rest of the valve by a broad furrow. The shell steep in front, sloping more gradually backwards, passing evenly into a relatively

large, flat "wing". Surface with fairly coarse, concentric ribs and with some fine, concentric lines.

Greatest length of the shell 14 mm, its breadth ca. 8 mm (measured at right angles to the length).

Distribution. North-East Greenland: "Kløft I" on Store Koldewey Island (2 spec.).

Russia: in limestone deposits of the Donez-Jurassic.

Germany: Upper Jurassic.

33. **Yoldia** sp.

A specimen of a small *Yoldia* was found in one of the black calcareous concretions occurring as boulders in Vesterdalen at Danmarks Havn. Unfortunately the specimen is so badly preserved, that a certain determination is impossible.

34. **Macrodon Keyserlingii** d'Orbigny sp.

1846. *Arca elongata* Sow.; Keyserling, Petschora-Land, p. 305; Pl. 17, figs. 1—4.
1850. — *Keyserlingii* d'Orbigny, Prodrome de Paléont., I, p. 369.
1883. *Macrodon Keyserlingii* d'Orb.; Lahusen, Jurass. Bild. Rjasanschen Gouv., p. 28; Pl. 2, figs. 14—15.
1905. — — — ; Borissjak, Pelecypoden der Jura-Ablagerungen im europ. Russland, II, p. 2 and 42; Pl. 1, figs. 5—8.

A left valve of a large *Macrodon* seems referable with certainty to this characteristic species. Only the inner side of the valve is accessible for examination however. The valve is strongly arched, very elongated, with very unequal sides. The anterior margin meets the cardinal margin at a slightly blunt angle, and the ventral margin shows a relatively deep concavity.

Height ca. 20 mm, length 50 mm.

A fragment of a right valve probably belongs here also.

Distribution. North-East Greenland: "Kløft II" on Store Koldewey Island (1 spec.). ? In a loose-lying stone at "4. Sænkning" (1 spec.).

Russia: in deposits belonging to Middle Callovian — Séquanian.

35. **Macrodon Schourovskii** Rouillier sp.

1847—48. *Cucullaea Schourovskii* Rouillier, Études progr. Géol. Moscou, II, p. 428. Pl. H, fig. 39.
1900. *Macrodon* — — sp.; Pompeckj, Jurassic Fauna of Cap Flora, p. 67; Pl. 1, fig. 17.
1905. — — — — ; Borissjak, Pelecypoden der Jura-Ablagerungen im europ. Russland, II, p. 12 and 48; Pl. 2, figs. 10-12.

Only a left valve can be referred to this species.

The valve trapezoidal, strongly arched; the umbo somewhat in front of the middle, inclined forwards rather strongly. Ventral margin

straight, almost parallel to the cardinal margin; posterior margin without concavity. A rounded keel from the umbo down to the posterior part of the ventral margin, bounding in front the hindmost, concave region of the valve. Area low. Surface with concentric striae.

Height 9·5 mm, length 19 mm, thickness (of the single valve) 5 mm.

Distribution. North-East Greenland: in a boulder on the south side of Vesterdalen at Danmarks Havn (1 spec.).

Franz Josephs Land: in Middle Callovian.

Russia: in Lower Volga deposits in Central Russia.

36. **Macrodon Mylii** n. sp.

Pl. XXXIV, fig. 1.

The shell little arched, very oblique, elongated in a diagonal direction. Anterior end narrow, posterior end very broad; the wings not sharply marked off from the rest of the shell; the diagonal ridge very much rounded and but little prominent. The beaks but little projecting, almost touching one another. The anterior margin rounded, forming a rounded corner with the cardinal margin. The posterior margin likewise somewhat curved, without concavity, forming a blunt angle with the ventral margin; the size of this angle increasing with age. The ventral margin with quite a slight concavity in its front part. The surface covered with concentric, regular folds, overlapping like tiles. Here and there — especially on the most strongly arched region of the shell — faint radial furrows. Area little evident, quite unusually low. The hinge not accessible for examination.

Height 14 mm, length 23 mm, thickness (2 connected valves) 7 mm.

This species is very nearly related to *M. Rouillieri* Lah., but is distinct from it by being much less arched and less elongated. In connection with the former characteristic, the ridge is much less prominent and the area considerably lower.

I have named the species after the leader of the Danmark Expedition, the author Mylius-Erichsen, who met his death on the ice-fields of Greenland.

Distribution. North-East Greenland: lying loose in the middle sandstone region of Store Koldewey Island (1 entire specimen).

37. **Macrodon Hagenii** n. sp.

Pl. XXXIV, figs. 3 and 4.

One or two, somewhat incomplete shells of a *Macrodon* greatly resemble *M. Keyserlingii*, but are so different, that I think it best to

describe them as a new species, which I have called after First-Lieut. N. P. HOEGH-HAGEN, the companion and fellow-sufferer of MYLIUS-ERICHSEN. The material, as mentioned, is somewhat imperfect. The best preserved specimen is a left valve, of which only the posterior half is preserved and the following description applies to it.

The valve not much arched; the umbo far in front of the middle of the shell; the posterior margin with a deep concavity; the ventral margin (on the preserved portion of the valve) almost parallel with the cardinal margin. Area fairly low. The surface covered with the usual concentric folds and radial ribs. From the umbo down to the front part of the ventral margin a characteristic, narrow depression, bounded posteriorly by a greatly raised edge and likewise well-defined in front; the middle part of the depression slightly raised and characterized by a narrow, but relatively deep concavity on the concentric lines.

From the same locality there is a right valve, which should rather be described as a cast with a portion of the valve preserved. It has an extremely irregular form, which is perhaps however due to pressure in part. The valve is strikingly high and its middle part is fairly strongly arched. The posterior wing has a distinct incision and the anterior margin forms almost a right angle with the cardinal margin. It is somewhat uncertain whether this valve belongs to the above species, but it is probable, as *inter alia* it also has the characteristic radial furrow from the beak to the ventral margin; on the ventral margin a narrow, but relatively deep concavity corresponds to this furrow. The height of the valve is 15 mm, its length 22 mm.

In form the species has some resemblance to *M. parallelum* ILOVAÏSKY, but is much higher.

Distribution. North-East Greenland: lying loose with the previous species in the middle sandstone region of Store Koldewey Island (1—2 spec.).

38. **Astarte striato-costata** MÜNSTER.

Pl. XXXIII, fig. 11.

1837. *Astarte striato-costata* MÜ.; GOLDFUSS, Petref. Germ., II, p. 192; Pl. 134, fig. 18.
1883. — — GOLDF.; LAHUSEN, Jurass. Bild. des Rjasanschen Gouv., p. 31; Pl. 2, fig. 26.

Very numerous specimens of one or several *Astarte* species were found in a coarse-grained sandstone from "Kløft II" on Store Koldewey Island. They are all badly preserved, almost without exception; some of them can perhaps be referred to *A. minima* PHILL., whilst a few larger specimens are sufficiently well-preserved, that they can be determined as *A. striato-costata* MÜ.

The shell fairly flat, ovoid to circular with small, pointed, median umbo. The anterior margin somewhat concave; the posterior margin straight, passing evenly over into the rather strongly curved ventral margin. The older parts of the shell covered with dense, concentric folds and with finer concentric striae; the younger parts smoother, with fainter concentric folds and striae.

Height and length 9 mm.

The available specimens show such great resemblance to some of the figures given by Ilovaïsky (especially with fig. 19) of *A. depressoides* Lahus.[1], that one might be tempted to refer them to this species, or perhaps more correctly to *A. levilimbata* Ilovaïsky, which is only distinguished from the former by having a smooth margin and can thus probably not be separated from it. On the other hand, they differ considerably in form from Lahusen's figures of this species[2], to which therefore I have not ventured to refer them.

Distribution. North-East Greenland: "Kløft I" on Store Koldewey Island (3 spec.).

Russia: in the zone with *Aspidoceras biarmatum* (Oxfordian).

Germany: Upper Dogger.

39. **Astarte minima** Phillips.

(1829) 1835. *Astarte minima* Phillips, Geology of Yorkshire, I; Pl. 9, fig. 23.
1853. *Astarte minima* Phillips; Morris and Lycett, Mollusca from the Great Oolite, II, p. 82; Pl. 9, fig. 10.
1858. — — — ; Quenstedt, Der Jura, p. 444; Pl. 61, fig. 4.
1861. — — — ; Trautschold, Recherches géologiques etc., p. 82; Pl. 7, fig. 6.

The shell strongly rounded-triangular, almost circular, fairly flat. The beak but little prominent. The surface covered with 10—12 rather coarse, concentric folds; the folds nearest the umbo the strongest; the younger part of the shell almost perfectly smooth.

Height ca. 3 mm; length a little more.

The available specimens from "Kløft I" agree well in form with the specimen figured by Trautschold from the black sand at Mniowniki, but seem to differ therefrom in the fact, that the folds are lost down towards the ventral margin. From English and German specimens they are distinguished by their less triangular form. Possibly they should rather be regarded as young specimens of *A. depressa* Quenst. (Der Jura, p. 505; Pl. 67, figs. 29—34) from "Brauner Jura ε"; in this species, namely, the younger parts of the shell may also be smooth as in the Greenland specimens.

[1] Ilovaïsky: L'Oxfordien et le Séquanien etc., p. 256; Pl. 9, figs. 12—22.

[2] Lahusen: Jurass. Bild. des Rjasanschen Gouv., Pl. 2, fig. 27.

Loose-lying stones from "4. Sænkning" contain a number of specimens, up to 9 mm high, of an *Astarte* with crenulated margin; these may also be referred probably to the present species.

Distribution. North-East Greenland: "Kløft I" on Store Koldewey Island (5 spec.); "4. Sænkning" on the same Island (many spec.).

Russia: black sand at Mniowniki.

Germany: Brauner Jura ε in Wurthemberg.

England: Great Oolite.

40. **Astarte alta** n. sp.

Pl. XXXIV, fig. 2.

The shell comparatively high and short, moderately arched, triangular-ovoid. The umbo median, pointed and very projecting, and bent somewhat forwards. The posterior margin slightly convex, passing rather abruptly into the strongly curved ventral margin; the anterior margin slightly concave. From the umbo down to the posterior part of the ventral margin a slightly concave depression. Lunula distinctly marked off. The surface covered with numerous, somewhat irregular, rather sharp, concentric ribs. The margin of the shell crenulated.

Height 13·5 mm, lenght 12 mm and thickness (of a single valve) 5 mm.

This species is distinguished from *A. striato-costata* Mü. by its high form and stronger ribs on the younger parts of the shell.

Distribution. North-East Greenland. "Kløft I" on Store Koldewey Island (1 spec.).

41. **"Astarte" retrotracta** Rouillier.

1847—48. *Astarte retrotracta* Rouillier, Études progr. Géol. Moscou; II étude, p. 414; Pl. G. fig. 29.

The valve small, oval, strongly arched. The umbo behind the middle of the valve, inclined somewhat forward; in front of it a distinct, oval lunula.

The shell itself is only in part preserved in the single available specimen; it seems to have been thin; its surface has only had finer and coarser concentric striae. The hinge cannot be seen for examination.

Height 9 mm, length 11·5 mm and thickness (of the cast of a left valve) ca. 3·5 mm.

Although the hinge is not known in the only specimen and the margin of the shell seems to be smooth, the resemblance otherwise

is so great — among other things in the characteristic position of the umbo — that I venture to refer the specimen to *A. retrotracta.*

Distribution. North-East Greenland: at "4. Sænkning" on Store Koldewey Island (1 left valve).

Russia: in "3. Etage" at Moscow.

42. **Tancredia curtansata** Phillips sp.

(1829) 1835. *Corbula curtansata* Phillips, Geology of Yorkshire. I. Pl. 3, fig. 27.
1854. *Tancredia* — — ; Morris and Lycett, Mollusca from the Great Oolite. III. p. 93; Pl. 13, fig. 7.

The shell rounded, obliquely triangular. The umbo somewhat behind the middle, little projecting. The anterior part of the shell compressed, pointed; the posterior part moderately arched. The margin in front of the umbo concave; the posterior margin convex, somewhat blunt, the ventral margin evenly curved. The hinge with a cardinal tooth and a long, posterior, lateral tooth in each valve. The surface of the shell with fine and coarse lines of growth.

A cast of a right shell: height 22 mm, length ca. 33 mm and thickness ca. 5·5 mm.

Distribution. North-East Greenland: in loose-lying stones at "4. Sænkning" on Store Koldewey Island (2 valves).

England: in Great Oolite and Coralline Oolite.

43. **Tancredia planata** Morris & Lycett.

Pl. XXXIII, fig. 10.

1854. *Tancredia planata* Morris & Lycett; Mollusca from the Great Oolite. III. p. 94; Pl. 13, fig. 10.

Some casts, one of which is almost perfect, seem to agree well with Morris and Lycett's above-cited description and figures (especially with fig. 10 b).

The shell triangular-oval, fairly flat. The umbo small, almost in the middle. The cardinal margin in front of the umbo slightly concave, behind the umbo slightly convex. The anterior margin rounded; the posterior margin likewise rounded, slightly truncate; the ventral margin evenly curved. The hinge not visible for examination.

The cast of a left valve: height 17 mm, length 25 mm.

Distribution. North-East Greenland: "Kløft I" on Store Koldewey Island (1 spec.). In free-lying stones at "4. Sænkning" on the same island (2 spec.).

England: Great Oolite.

44. **Tancredia axiniformis** Phillips sp.

Pl. XXXV, fig. 1.

(1829) 1835. *Nucula axiniformis* Phillips, Geology of Yorkshire. I. Pl. 11, fig. 13.
1850. *Tancredia extensa* Lycett, Fossil Shells from the Inf. Oolite. p. 407; Pl. 11, fig. 9.
1854. — *axiniformis* Phill.; Morris and Lycett, Mollusca from the Great Oolite. III. p. 93; Pl. 12, fig. 7 and Pl. 13, fig. 6.

The shell rather flat, triangular-oval, elongated. The umbo almost in the middle, pointed. The anterior and posterior margins almost straight, passing very abruptly into the slightly curved ventral margin. The front part of the shell less arched than the posterior part. In the neighbourhood of the posterior margin a somewhat rounded, but very distinct radial ridge; the region behind this somewhat concave. The surface of the shell with fine lines of growth.

Height ca. 13 mm, length ca. 24 mm, thickness (of a single valve) ca. 2·5 mm.

All the available specimens are badly preserved; they seem to agree very well with Morris and Lycett's fig. 7, Pl. 12. — Along with this a portion of the cast of a right shell was found, which possibly belongs to the same species. This seems to show, that each valve has had a blunt cardinal tooth and an elongated, posterior, lateral tooth.

For the sake of comparison I have had specimens from Langrune and Ranville (Calvados); the only difference between these and the Greenland specimens seems to be, that the ventral margin in the latter is a little more curved, thus causing the whole form to be a trifle higher.

Distribution. North-East Greenland: "Kløft I" on Store Koldewey Island (5 spec., 1 with both valves). In free-lying stones at "4. Sænkning" on the same island (3 valves). — On the south-east slope of Muschelberg (Hochstetter's Foreland) at a height of 370 m above the sea (1 valve?).

England: Inferior Oolite and Great Oolite.

France: in Grand Oolite.

45. **Tancredia Jarneri** n. sp.

Pl. XXXV, fig. 3.

A number of characteristic casts seem referable to all appearance to a new species of the genus *Tancredia*.

Description of the cast: strongly arched; the form somewhat variable, oblong, triangular-oval. The anterior end rounded, sometimes rather pointed; the posterior end blunter; the ventral margin rather slightly curved. The umbo almost median, little prominent.

In the neighbourhood of the cardinal margin and in front of the umbo a somewhat excavated region; between this and the cardinal margin an oblong, small but strong prominence, and in front of this a larger projection (imprint of the anterior adductor), which is lost below. Behind the umbo a depression which runs in an oblique direction towards the posterior part of the ventral margin, though not reaching quite to the latter; it is bounded posteriorly by a projecting part (imprint of the posterior adductor). Along the posterior part of the cardinal margin a broad furrow, which vanishes after passing a small, marked depression lying above the impression of the posterior adductor. The impressions of the adductors not distinctly marked off; the pallial line without sinus. Of teeth only 1 cardinal tooth apparent in each valve, that of the left valve lying in front of that of the right.

As mentioned, the form varies considerably, as is shown by the following measurements of two casts:

Height	Length	Thickness
32 mm	68 mm	20 mm
37 —	54 —	17 —

All transitions seem to occur between the extreme forms, so that all the available specimens probably belong to one and the same species. — A few fragments preserved of the shell itself show, that the surface of the shell has been covered with the usual, concentric lines of growth.

During the Danish Expedition to the east coast of Greenland in 1891—92 a single cast of a left valve of the same or a very nearly related species was found at Cape Stewart. The incompleteness of the material does not permit of a certain determination. Lundgren, who worked up the Jurassic fossils brought by the Expedition from Cape Stewart, does not mention this specimen.

Distribution. North-East Greenland: "Kløft II" on Store Koldewey Island (22 casts). In a loose-lying stone at "4. Sænkning" on the same island (cast of a left valve). — In loose-lying stones from the river-bed through Muschelberg on Hochstetter's Foreland (3 casts). Top of Muschelberg (cast of two connected valves).

East Greenland: ? Cape Stewart (cast of a left valve).

46. **Lucina substriata** Roemer?

1835. *Lucina substriata* Roemer, Verst. des norddeutsch. Oolithen-Geb. p. 118; Pl. 7, fig. 18.

1874. — — — ; Brauns, Der obere Jura. p. 285.

I have not been able to refer some rather badly preserved specimens of a *Lucina* with full certainty to any earlier described species. They seem to come nearest to *L. substriata*, to which they

should possibly be referred. They are more or less complete casts, with here and there the inner layer of the shell preserved.

The shell to some extent circular, somewhat elongated in front. The umbo almost median, somewhat projecting. The posterior part of the circumference of the shell semicircular, but with a pair of faint concavities. The margin in front of the umbo strongly concave. On the hindmost portion of the shell a deepened part, extending from the umbo down along the posterior margin; this depression well-marked on the cast. The surface probably with fine, concentric striae and with fine radial lines; the latter also apparent on the cast. — The hinge and muscular impressions not apparent.

Height ca. 47 mm, length ca. 51 mm and thickness (cast of a double-valved spec.) 19 mm. The largest specimen is ca. 60 mm high.

A small, badly preserved specimen from "4. Sænkning" perhaps belongs to the same species, but seems to be more strongly arched than the other Greenland specimens.

Distribution. North-East Greenland: "Kløft II" on Store Koldewey Island (3 spec., 2 of them double-valved). ? At "4. Sænkning" in loose-lying stone (1 spec.).

Germany: in Kimmeridgian at numerous localities in North Germany.

France: in Kimmeridgian-Portland.

47. **Protocardia** sp.

I have not been able with certainty to refer some specimens of a *Protocardia* to any species known to me.

The shell rather strongly inflated, rounded-trapezoidal, with unequal sides; the umbo inclined somewhat forwards. The anterior margin rounded and passing evenly into the rather slightly rounded ventral margin. The posterior margin somewhat elongated downwards and grading fairly evenly into the ventral margin. The whole of the surface, with exception of the hindmost part, smooth, showing only fine, concentric lines of growth. In the neighbourhood of the posterior margin a strongly rounded radial ridge; the shell behind this sloping very steeply down towards the posterior and cardinal margins. Behind the ridge ca. 8 rather faint radial ribs, and in front of the ridge a few still fainter. The part of the margin touched by the ribs crenulated, the remainder smooth.

A single valve is 19 mm high, 18 mm broad and ca. 6 mm thick.

Possibly the specimens described (3 in number), which were found in "Kløft I" on Store Koldewey Island, may be referred to

Pr. eduliformis Roem. sp. They seem to agree to a certain extent with Roemer's description of his *"Venus trapeziformis"*, which is said to be identical with the species mentioned, but nevertheless seem to be somewhat more strongly inflated. Owing to the lack of material for comparison I am not able to settle this question.

At "4. Sænkning" on Store Koldewey Island 4 specimens of a *Protocardia* were found, which may belong to the same species as the above-described from "Kløft I".

48. **Cyprina cfr. mosquensis** d'Orbigny.

Pl. XXXV, fig. 2.

Some casts of a *Cyprina* greatly resemble casts which are preserved in the collections of the Mineralogical Museum under the name *Cyprina mosquensis* d'Orb. and which are stated to have been found at Kharoschowo at Moscow. Unfortunately, I cannot find, where this form is described.

The cast evenly and comparatively slightly arched, rather oblique, with pointed, projecting umbo, which inclines strongly forwards. The angle at the umbo ca. 110°; the anterior margin grading evenly into the ventral margin and this again into the posterior margin. The hinge as usual in *Cyprina* with 3 cardinal teeth and 1 lateral tooth in the ventral valve posteriorly. Muscular impressions and pallial line not observed.

Height 14 mm, breadth 18 mm and thickness 7 mm.

The casts described differ from *C. mosquensis* especially in that they are somewhat less arched; further, the umbo is more pointed and inclined somewhat more forwards. But in the former character, especially, the Russian species seems to vary considerably.

Another cast from the same locality as the above greatly resembles these, but has a somewhat longer anterior end and in consequence a more median umbo and the ventral margin in a flatter curve. It is doubtful, therefore, whether it can be referred to the same species.

Distribution. North-East Greenland: "Kløft I" on Store Koldewey Island (3—4 specimens).

Russia: the above-mentioned specimens of *C. mosquensis* are stated to have been found at Kharoschowo in deposits belonging to Malm β.

49. **Cyprina kharoschovensis** Rouillier.

Pl. XXXV, fig. 4.

1847—48. *Cyprina kharoschovensis* Rouillier, Études progr. Géol. Moscou. II. p. 421; Pl. H, fig. 32.

The shell rounded, triangular, rather flat. The umbo far in front of the middle, bent strongly forwards. The anterior margin and the

front part of the ventral margin forming a semicircle; the posterior part of the circumference very like the half part of an ellipse. The shell strongly arched in the neighbourhood of the posterior margin, otherwise rather flat. No sinus on the pallial line. The hinge not observed.

Height of the cast 28 mm, its length 36 mm and thickness (of a single valve) ca. 7 mm.

To judge from the right valves the available casts agree very well with ROUILLIER's above-cited figure.

Distribution. North-East Greenland: "Kløft I" on Store Koldewey Island (1 spec.). At "4. Sænkning" also on Store Koldewey Island (1 spec.). — On the top of Muschelberg, Hochstetter's Foreland (2 spec.).

Russia: at Kharoschowo.

50. Cyprina Syssollae KEYSERLING.

Pl. XXXV, fig. 6.

1846. *Cyprina Syssollae* KEYSERLING, Petschora-Land, p. 309; Pl. 17, figs. 17—22.

The shell rounded-triangular, relatively higher and shorter than in the previous species, fairly flat. The umbo somewhat in front of the middle, rather prominent. — The front part of the cardinal margin more concave than in the previous species. Lunula not sharply marked off. The surface covered with coarse and fine, concentric striae.

All the available specimens (casts and imprints) are more or less defective; their form has been partly somewhat altered by pressure. The following measurements can be given of an imprint of a right valve somewhat deformed in this way:

Height 25 mm, length 29 mm and thickness ca. 9 mm.

Distribution. North-East Greenland: "Kløft I" on Store Koldewey Island (many spec.). At "4. Sænkning" on the same island (5 spec.). — Top of Muschelberg on Hochstetter's Foreland (1 spec.).

Russia: in deposits with *Belemnites Panderianus*.

51. Cyprina cfr. inconspicua LINDSTRÖM.

1865. *Cyprina inconspicua* LINDSTRÖM, Trias- och Juraförsteningar från Spetsbergen. p. 11; Pl. 3, figs. 7—8.

A cast of a left valve and a second specimen with the greater part of the shell preserved have a great resemblance to this species, but yet differ so much from it, that they must perhaps be referred to another species.

Oblong-oval, comparatively little oblique and rather strongly arched. The umbo a little in front of the middle. The circumference evenly rounded. The surface with fine, concentric lines of growth, otherwise smooth.

Height 18 mm, length 23 mm, thickness ca. 5 mm.

The available specimens differ from Lindström's original examples especially in that they are higher and more strongly arched. It is possible, however, that these original examples were somewhat deformed by pressure.

Distribution. North-East Greenland: "Kløft I" on Store Koldewey Island (1 spec.). In a loose-lying stone at "4. Sænkning" on the same island (1 spec.).

52. **Cyprina Panderi** Rouillier sp.?

1847—48. *Astarte Panderi* Rouillier, Études progr. Géol. Moscou. II. p. 413; Pl. G, fig. 28.

I am inclined to refer some few, incomplete shells to this species, especially from the nature of the surface.

The shell rather strongly arched, slightly triangular-circular, comparatively little oblique. The umbo a little in front of the middle. The surface with characteristic, sharp, canaliculated, concentric furrows at regular distances from one another; further with very fine, concentric lines.

Rouillier states, that this species forms a connecting link with the genera *Astarte, Lucina* and *Cyprina,* and that it is very nearly related to *C. Syssollae.* To judge from the hinge, which he figures, it seems most natural to refer it to the genus *Cyprina,* also because it lacks the distinct, anterior pedal scar which is characteristic for the genus *Astarte.*

Distribution. North-East Greenland: "Kløft I" on Store Koldewey Island (3 spec.).

Russia: in the 2. Etage of the Moscow Jurassic.

53. **Pleuromya peregrina** d'Orbigny sp.

1845. *Panopaea peregrina* d'Orbigny; Murchison, de Verneuil et Keyserling, Géologie de la Russie d'Europe. II. p. 468; Pl. 40. figs. 10—12.

1847. *Panopaea peregrina* d'Orb.; Rouillier, Études progr. Géol. Moscou. II. p. 406.

1881—85. *Pleuromya peregrina* d'Orb.; Zittel, Handbuch der Paläontologie. II. fig. 179.

The shell thin, rather strongly arched, rounded triangular; the anterior margin truncated, the posterior margin more curved, the ventral margin slightly curved. The umbo somewhat in front of the middle, but little prominent, bent strongly inward and somewhat forward.

Height 15 mm, length 24 mm.

Of this species we have only a couple of valves, which agree well with some casts from the Moscow Jurassic; they seem only to be a little less arched. The characteristic nature of the surface cannot be observed, which is probably due however to the fact, that the surface of the valves is somewhat weathered.

Distribution. North-East Greenland: "Kløft I" on Store Koldewey (1 spec.). In a loose-lying stone at "4. Sænkning" on the same island (1 spec.).

? Spitzbergen: at Advent Bay.

Nova Zembla: at Besimannaja.

Russia: at Kharoschowo.

54. **Goniomya** sp.

A single, very imperfect cast from the sandstone on the top of Muschelberg, Hochstetter's Foreland, must be referred to the genus *Goniomya* from its whole form and characteristic sculpture; to determine the species is impossible.

55. **Dentalium nodulosum** Lundgren.

1883. *Dentalium nodulosum* Lundgren, Jura- und Trias-Fossilien. p. 10; Pl. 2, figs. 7—9.

At several localities the *Dentalium* tubes belong to the fossils of most frequent occurrence in the sandstone. In any case a number of them seem referable to *D. nodulosum* Ldgrn.

Thick-walled, slightly bent tubes of up to 3 mm in diameter, frequently more or less uneven in thickness. The surface with coarse transverse lines and irregular constrictions and folds.

One might be inclined to think from their whole appearance, that these were *Serpula* tubes, but the structure of the shell agrees with that of the *Dentalium* tube.

Distribution. North-East Greenland: in boulders at Vesterdalen at Danmarks Havn (many spec.); "Kløft I" on Store Koldewey (numerous spec.). — In loose-lying stones at "4. Sænkning" on Store Koldewey Island (numerous spec.).

Spitzbergen: in the Jurassic.

In one of the black concretions occurring as boulders in Vesterdalen at Danmarks Havn 3 specimens were found of a small *Dentalium*. The shell is thin, smooth and shiny; but some irregular cross-wrinkles can be seen under the lens. The specimens are too imperfect to permit of a closer determination.

56. **Amberleya groenlandica** n. sp.

Pl. XXXV, fig. 5.

The shell turbinate with slightly arched whorls. Almost on the middle of the whorls a strong spiral ridge beset with a series of fairly large nodes; under this ridge and a little above the lower suture a similar spiral ridge with more numerous and smaller nodes; the interval between these ridges slightly excavated. The region between the upper suture and the upper ridge greatly excavated. Almost in the middle of this region, but a little nearer the suture a series of scattered nodes almost of the same size as those on the lower spiral ridge. The whole of the surface, further, covered with fine transverse ribs, at fairly regular distances from one another. The under-surface of the last whorl preserved rounded and with a number of raised spirals. Form of the mouth not observed.

Height 11 mm, thickness 10 mm.

I have not been able to refer the species described to any species known to me. In the Munich Museum I have seen some shells from Vaches noires (Calvados), which are labelled *Eucyclus (Littorina) Meriani* Goldf., a number of which have a considerable resemblance to the Greenland specimen, but the region above the upper ridge is flat and not excavated; further, the underside of the whorls is more strongly arched and there are also 2 rows of nodes over the upper ridge.

Distribution. North-East Greenland: in a loose-lying stone, found 50 m above the sea down from "Trækpasset" on Store Koldewey Island (1 spec.).

57. **Amberleya Jasicofiana** d'Orbigny sp.?

1845. *Turbo Jasicofianus* d'Orbigny in Murchison, Verneuil et Keyserling, Géologie de la Russie d'Europe. II. p. 451; Pl. 37, figs. 19—20.

A single cast of an *Amberleya* seems to agree perfectly with casts of this species which I have seen in Munich Museum, and which are stated to have come from Mniowniki at Moscow. For a certain determination, however, the material is too imperfect.

The last of the whorls preserved has borne 3 or 4 spiral ridges. The cross-section of the whorl is rounded, its height a little greater than the breadth.

Distribution. North-East Greenland: in a loose-lying stone from "4. Sænkning" on Store Koldewey Island (1 spec.).

58. **Natica** sp.

Some imperfect *Natica* shells (6 spec. from "4. Sænkning" and 2 spec. from "Kløft I" on Store Koldewey Island) cannot be deter-

mined to their species. In form most of them show a considerable resemblance to *N. plicata* Mü. (Goldfuss: Petrefacta Germaniae. III. p. 119; Pl. 109, fig. 15) from Lindner Berg in Hanover, but the transverse folds of the last whorl seem to be wanting. — One of the two specimens from "Kløft I" is considerably smaller than the others and probably belongs to a different, more slender species.

59. **Turritella** sp.

Pl. XXXV, fig. 7.

From "Kløft II" on Store Koldewey Island there is a fragment of a *Turritella,* consisting of ca. 5, extremely well-preserved whorls. It probably belongs to a hitherto underscribed species.

Very elongate-turreted with numerous, flat whorls, separated by little obvious sutures. Uppermost on the younger whorls present a very narrow and quite faint excavated band, on which there is a pair of quite fine, raised spirals. The rest of the shell covered with numerous, rounded spirals of variable breadth and with somewhat variable interspaces; the last usually less than, sometimes equal to the breadth of the spirals. Lines of growth fine, in an even curve.

On the second-last whorl present, with a diameter of 8 mm, the number of spirals is 9.

The whole appearance greatly resembles that of a *Nerinea,* but there is no trace of the internal folds characteristic of this genus.

A second, less well-preserved specimen from "Kløft I" on Store Koldewey Island probably belongs to this species.

In the boulder containing *Aucella mosquensis* from Harefjæld at Danmarks Havn a stump was found of a quite indeterminable *Turritella* species.

60. **Chemnitzia undulata** Tullberg sp.

1881. *Eulima undulata* Tullberg, Aucella-Schichten Novaja Semljas. p. 10; Pl. 2, figs. 26—27.

Short turreted with slightly arched whorls. These separated by deep sutures and — in the case of the older ones — covered with fairly coarse, curving, rounded transverse ribs; the younger whorls on the other hand smoother, without regular transverse ribs, but with coarse and fine, curving lines of growth. Further, numerous very fine spirals. The aperture probably oviform, with a pointed angle above.

Length ca. 8 mm, thickness ca. 4 mm.

Although numerous specimens of the species are present, I have not seen a single complete shell. According to Tullberg's description there should be transverse ribs on all the whorls; his figures

seem to show, however, that the younger whorls may lack the transverse ribs.

Distribution. North-East Greenland: "Kløft I" on Store Koldewey Island (many specimens). In loose-lying stones at "4. Sænkning" on the same island (many spec.).

Nova Zembla: in bituminous limestone at Skodde Bay.

61. **Chemnitzia hamptonensis** Morris & Lycett.

Pl. XXXV, fig. 8.

1854. *Chemnitzia Hamptonensis* Morris & Lycett, Mollusca from the Great Oolite. p. 50; Pl. 7, fig. 1.

The shell more slender than in the previous species; otherwise resembling this greatly. The whorls flat or slightly arched, separated by deep sutures. The older whorls with numerous, fairly strongly curved, rounded transverse ribs; the younger whorls with faint, irregular transverse folds and distinct, curving and obliquely placed lines of growth.

Length ca. 9 mm, thickness ca. 3·5 mm.

This species occurs in considerable abundance along with the preceding, from which it is so little different, that better material will probably prove it to be the same species.

Distribution. North-East Greenland: "Kløft I" on Store Koldewey Island (several spec.). In loose-lying stones at "4. Sænkning" on the same island (several spec.).

England: in Great Oolite.

62. **Aporrhais** sp. (I).

In two of the black concretions (with *Garnieria*) occurring as boulders at Danmarks Havn, there are numerous species of an *Aporrhais.* Unfortunately it has not been possible to separate an even approximately complete specimen.

The older whorls are strongly arched; the younger have a strong ridge along the middle. Under this ridge on the last whorl there is a second, somewhat fainter ridge. The outer lip forms a short wing, on which the two ridges of the last whorl run out and continue further as two long (?), diverging fingers. Behind, as usual in the genus, there is a canal up along the lowermost part of the spire. Otherwise the shell is covered with fine, raised spirals, at variable, but as a rule comparatively great distances from one another.

It has not been possible for me to refer these specimens to any hitherto known species; probably the species is new.

63. **Aporrhais** sp. (II).

In the same concretions, which contained the previous species, are a number of other specimens, which in all probability belong to a different species of the genus *Aporrhais.*

All the whorls are strongly arched. No true ridge occurs, but on the other hand a very strong spiral, which lies somewhat above the middle of the whorls; it is bounded on both sides — especially below — by a depression. The outer lip forms a large, broad wing, the outer boundary of which cannot be seen on the available specimens. Otherwise the sculpture consists of a large number of fine spirals, which seem however to be somewhat coarser and denser than in the preceding species, just as the lines of growth are much more distinct. I have not succeeded in referring these specimens either to any known species.

64. **Lytoceras polare** n. sp.

Pl. XXXV, fig. 9.

I have been unable to refer a fairly well-preserved specimen of a *Lytoceras* to any species known to me.

The whorls slightly overlapping, almost circular in section (to a breadth of 15 mm corresponds a height of 12·5 mm, measured in the middle line); its greatest breadth lying a little nearer the umbilicus than the external side. The greatest diameter of the specimen 42 mm with a corresponding width of umbilicus of 16 mm. On the surface somewhat distant, slightly curved, raised transverse lines at fairly equal distances from one another; between them indications of other dense, fine lines, somewhat variable in size. — The suture-line in part distinct, strongly toothed, with a very narrow siphonal saddle, and the characteristic, cross-shaped, antisiphonal lobe; auxiliary lobes wanting. The external lobe and 1st lateral lobe almost equally deep (probably the specimen is not fully developed).

It will be seen from the above, that this species is one of the typical Fimbriates. In form it greatly resembles *L. Sacya* Forb., but the suture-line and sculpture of the latter are very different, as it belongs to the subgenus *Gaudryceras* Gross. (*emend.* Kossmat). A more nearly related form is *L. ezoense* Yabe, but this species also has a different sculpture.

Distribution. North-East Greenland: in a limestone concretion found as boulder on the north side of Vesterdalen at Danmarks Havn (1 spec.).

65. **Cardioceras alternans** v. Buch sp.

Pl. XXXVI, figs. 1, 2 and 3.

(1831) 1885. *Ammonites alternans* v. Buch, Pétrifications remarquables. p. 145; Pl. 18, fig. 4.

1845. *Ammonites subcordatus* d'Orbigny, in Murchison, Verneuil et Keyserling, Géologie de la Russie d'Europe. II. p. 434; Pl. 34, figs. 6—7.

1846. — *alternans* v. Buch; Keyserling, Petschora-Land. p. 323, Pl. 22, fig. 2.

1849. — — — , Quenstedt, Die Cephalopoden. p. 96; Pl. 5, figs. 7—8.

— — — — , Rouillier, Études progr. Géologie de Moscou. V. p. 362; Pl. L, fig. 88; Pl. M, fig. 109.

1878. *Amaltheus alternans* Buch; Nikitin, Group of *Amaltheus funiferus* Phill. p. 148; Pl. 2, fig. 18.

1881. — — — ; Nikitin, Jura-Ablagerungen an der oberen Wolga. p. 59.

1904. *Cardioceras* — — ; Ilovaïsky, L'Oxfordien et le Séquanien etc. p. 272; Pl. 11, figs. 6—7.

Some specimens of this extremely variable species were found in "Kløft I" on Store Koldewey Island in the blue-gray, calcareous and micaceous sandstone. They are all more or less imperfect and in part much compressed. A well-preserved and practically complete imprint shows short, but well-marked ribs only in the neighbourhood of the external side on the beginning of the last of the whorls preserved, but the sides are smooth; later, ribs also appear on the edge of the umbilicus; these ribs become stronger and stronger, continuing over the side and in the end joining on to the first-mentioned ribs, which at the end curve strongly forwards and disappear before reaching the ridge, so that the latter is bounded on each side by a smooth band. The number of ribs externally is almost double that on the umbilical margin, as a short rib is as a rule inserted on the outside towards the periphery between each two of the ribs, which start from the umbilical edge. The latter ribs show more or less distinctly a thickening, which lies almost midway on the side, though a little nearer the external side. The ridge is very finely dentated. The greatest diameter of this specimen is 31 mm and the greatest height of the whorl 14 mm. In the whole of its sculpture it shows a considerable resemblance to the specimens of *C. Volgae* Pavl., described by P. G. Krause and found in the Kimmeridgian in East Prussia;[1] but it is distinct from this in that especially the insertion of the secondary ribs is more regular and the dentation of the ridge much finer.

In addition to this specimen we have a couple of compressed

[1] P. G. Krause: Ueber Diluvium, Tertiär, Kreide und Jura in der Heilsberger Tiefbohrung. p. 241; Pl. 3, figs. 1—4. — Jahrb. Preuss. geolog. Landesanst. Bd. 29. Berlin 1908.

specimens of similar dimensions, which seem to be nearly related to it. This is also the case with a small cast, which shows the suture-line very distinctly. This line is simple on the whole and forms a broad external lobe, which is divided by a short, but broad siphonal saddle. After the external lobe comes the broad, slightly bilobed external saddle. The first lateral lobe is deep, rather narrow and ends in 3 points, the middle one being comparatively long. The first lateral saddle is fairly broad and quite slightly bilobed. The second lateral lobe is very short and small and has but few, faint teeth. The second lateral saddle is likewise very small and only slightly indented. The remaining part of the suture-line is somewhat indistinct.

Fig. 2. The suture-line of *Cardioceras alternans* v. Buch sp. Height of the whorl 9 mm.

Three other specimens from the same locality have ribs, which are unusually strong, especially in the middle of the sides and in the neighbourhood of the external side; they agree well with specimens from Skodde Bay in Nova Zembla, which I have seen in the Stockholm Riksmuseum. This is also the case with 2 specimens, found in loose-lying sandstones at "4. Sænkning" on Store Koldewey Island.

A couple of imprints in the yellowish, fine-grained sandstone from Muschelberg on Hochstetter's Foreland likewise belong to this species. One of the imprints is to some extent complete and is very similar to the first-mentioned imprint from "Kløft I" on Store Koldewey; the ribs however are on the whole more distinct on the sides, especially on the older parts of the shells.

Distribution. North-East Greenland: "Kløft I" on Store Koldewey (8 spec.). In loose-lying sandstones at "4. Sænkning" on the same island (2 spec.). — Hochstetter's Foreland (2 spec.).

Europe: this species has a wide distribution on the boundary between the Oxford and Kimmeridgian deposits.

66. **Cardioceras Nathorsti** Lundgren sp.

Pl. XXXV, fig. 10.

1883. *Ammonites* (*Amaltheus*) *Nathorsti* Lundgren, Jura- und Trias-Fossilien. p. 6; Pl. 1, figs. 1—2.

Some incomplete, more or less compressed casts from the "Kløft II" agree quite well with Lundgren's description and figures of this species. — Thus, the shell has also originally been greatly compressed. The ribs are frequently unbranched, fairly strong and sharp; on the sides they are only slightly bent; on the external side they curve somewhat abruptly forwards and disappear before they reach

the keel, so that this is bounded on both sides by a smooth band. The keel is well-developed and very finely dentated; the number of teeth is far in excess of that of the ribs. The suture-line is fairly strongly dentated; the first lateral lobe is deep and ends in 3 points, the middle one being much longer than the others; the second lateral lobe is very short.

Fig. 3. The suture-line of *Cardioceras Nathorsti* Ldgrn. sp. Height of the whorl 21 mm.

A single fragment from "Kløft I" agrees with the above specimens in regard to the sculpture; on the other hand, the suture-line is perhaps somewhat different.

A small, less well-preserved specimen of a *Cardioceras* from "4. Sænkning" may perhaps be referred to this species, owing to the densely placed ribs and the fine dentation of the keel.

Distribution. North-East Greenland: "Kløft I" on Store Koldewey (1 spec.?). "Kløft II" on the same island (3 spec.). In loose-lying boulder at "4. Sænkning" likewise on Store Koldewey Island (1 spec.?).

Spitzbergen: Séquanian-Kimmeridgian.

67. **Cardioceras** sp.

Pl. XXXV, fig. 11.

A fairly complete, but not quite well-preserved imprint of an Ammonite must be referred to one or other species of the genus *Cardioceras*. It was found at "Kløft I" on Store Koldewey Island along with *C. alternans*. From this it is distinguished especially by the fact, that the ribs on the youngest part of the shell are very much raised on the middle of the side and form here a marked row of nodes; a similar row, but with smaller nodes, occurs on the umbilical edge; uppermost on the side the ribs are likewise strongly developed and inclined forwards. There seems to be a considerable resemblance with the form, which Ilovaïsky (l. c., p. 272, Pl. 11, fig. 6) describes and figures under the name of *C. cf. alternans* Buch and considers as a transition form between a variety of *C. cordatum* Sow. and *C. alternans*. But in this form the ribs are somewhat denser and their uppermost part (nearest the keel) not so sharply bent. The dentation of the keel, on the other hand, seems to be quite similar.

68. **Quenstedtoceras** (?) sp.

Pl. XXXVI, fig. 4.

A small fragment of an Ammonite belongs perhaps to a species of this genus. It was found in the free-lying brownish sandstone

down from “Trækpasset” on Store Koldewey Island at a height of 50 m above the sea.

The shell has been somewhat involute with inflated whorls. The breadth of the whorl far exceeds its height; the external outline from edge to edge of the umbilicus is very approximately a semicircle; the older whorls have been relatively higher. Edge of the umbilicus not sharply marked. The ribs strong, especially in the neighbourhood of the edge of the umbilicus; a few divide into two a little below the middle of the side; at other places a new rib is inserted. In the cases of dichotomy the two ribs do not unite again on the other side, but join on to the rib respectively before and behind. From the umbilicus to the umbilical edge the ribs are bent somewhat backwards; then they bend forwards and on the external part form a distinct arch bent forwards; they course over the external part without interruption.

Height of the whorl 20 mm, breadth 29 mm.

The available fragment has a no slight resemblance to an Ammonite, which Lahusen (l. c., Pl. 4, fig. 11) figures under the name of *Cardioceras carinatum* Eichw., but the material is too incomplete for a certain determination.

69. **Cosmoceras boreale** n. sp.

Pl. XXXVI, figs. 5 and 6.

The shell with rather small umbilicus and with inflated whorls; the older whorls lower and thicker than the younger. The slope down towards the umbilicus short, but steep. The thickness of the whorl increasing from the edge of the umbilicus; its greatest thickness at about 1/3rd of the distance from the umbilical edge to the external side; here a spiral row of small, pointed nodes. The region from this up to the external side convex. The external side itself with a distinct furrow. The sides covered with rather fine, sharp ribs, beginning right down at the umbilicus and directed somewhat forwards. No marked nodes on the umbilical edge, but here the ribs are specially strong. Dichotomy of all the ribs at the lowermost row of nodes; at the same height sometimes insertion of new ribs. Never junction of ribs at the external edges; on the other hand, the ribs here as a rule somewhat swollen, but without any true formation of nodes. No appreciable weakening of the ribs in the external furrow. — The suture-line dentated comparatively coarsely; the external lobe rather narrow; the first lateral lobe with one point, of the same length as the external lobe.

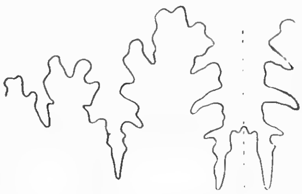


Fig 4. Suture-line of *Cosmoceras boreale* n. sp. Height of the whorl 8 mm.

The most complete specimen has the following dimensions: diameter 21 mm; greatest height of the whorl 9 mm, thickness 8·5 mm; width of the umbilicus 6 mm; distance between the external edges 2 mm.

In sculpture the species described resembles *C. Jason* Rein., but the whorls are lower and thicker; further, nodes at the umbilical edge are practically wanting. It resembles more a shell from Swistowo (Gouv. Rjasan), which Lahusen (l. c., Pl. 6, fig. 8) has figured under the name of *C. Gowerianum* Sow. To judge from the figure, however, this shell has a considerably wider umbilicus and the transverse section of the whorl is more hexagonal; further, the row of nodes on the sides lies here more to the middle of the flanks. On the other hand, there is fairly good agreement between the suture-line in the Greenland species and in *C. Gowerianum*, which Lahusen (l. c., Pl. 7, fig. 1) figures; but this latter is somewhat more finely dentated, which is perhaps due however to its belonging to an older specimen. Agreement is also shown in the fact, among others, that the first lateral lobe is not deeper than the external lobe, as is usually the case in the genus *Cosmoceras*.

Distribution. North-East Greenland: in the loose-lying, brownish sandstone, found at 50 m above the sea on Store Koldewey Island down from "Trækpasset" (8 spec.).

70. **Kepplerites Tychonis** n. sp.

Pl. XXXVII, fig. 1.

Large, discoidal shell with fairly wide umbilicus. The whorls growing very slowly, greatly overlapping; but the last whorl becoming gradually less and less so. Height of the inner whorls almost the same as their thickness; the height of the outer on the other hand greater. Edge of the umbilicus specially well-marked, rounded. The flanks but slightly arched. The external side evenly rounded, but distinctly flattened on the innermost whorls, without external furrow. The sculpture on the outer whorls in the form of very numerous, very sharp ribs, originally directed strongly backwards, but already over the edge of the umbilicus inclining slightly forwards, dividing into several branches a little above this and forming flat arches directed forwards over the external portion. — The suture-line unusually strongly dentated with broad saddles and narrow lobes. The external lobe deep and narrow, divided by a very projecting median saddle. The external saddle extremely broad and very deeply incised. The first lateral lobe a little deeper than the external lobe, trilobed. The two lateral saddles broad, but much smaller than the external saddle. The second lateral lobe much shorter than the first lateral lobe. Auxiliary lobes and saddles small and indistinct.

Greatest diameter 104 mm; width of the umbilicus 32 mm; height of the last whorl 39 mm, its thickness ca. 32 mm.

How far a greatly weathered fragment of an Ammonite, found along with the above-described, can be referred to the same species, is somewhat doubtful. The sculpture and suture-line seem to agree, but the whorls are comparatively higher. Further, the external part is flattened even on a whorl with a height of 19 mm, whilst it is uncertain, if this is the case at the same stage in the first-mentioned specimen.

I have been in some doubt, as to whether the species described here should be referred to *Macrocephalites* or to *Kepplerites*. In referring it to the latter genus my reason is, that on breaking it in two I succeeded in laying open one of the innermost whorls, and it

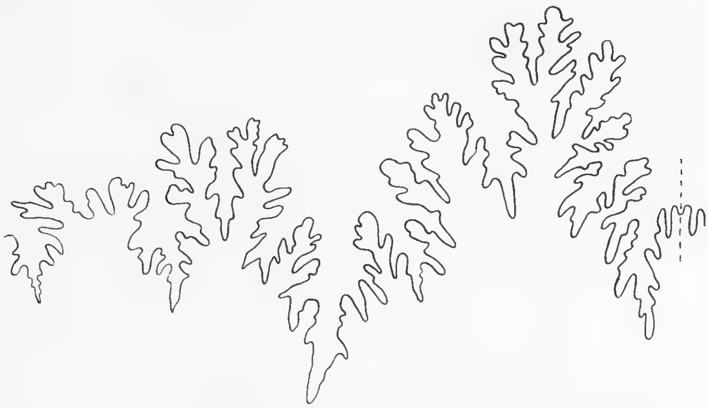


Fig. 5. The suture-line of *Kepplerites Tychonis* n. sp. Height of the whorl 29 mm.

shows a distinct flattening on the external side. Unfortunately, I did not succeed in getting the whole flank prepared free, so that I do not know, whether nodes occur here on the points of division of the ribs. This whorl is only 8 mm in diameter. How early this flattening begins and how long it continues, I have not been able to see, nor has it been possible to observe a "Parkinsonia-stage" preceding this "Runcinate-stage"[1]. This flattening of the external side of the inner whorls along with the striking resemblance between the suture-line and the suture-line of *K. Galilaei* Opp. sp., as figured in Neumayr and Uhlig (l. c., Pl. 3, fig. 4 c), seems to me to show, that the species must be referred to the genus *Kepplerites*.

I have called this species after the famous Danish astronomer Tycho Brahe.

[1] Regarding the genus *Kepplerites* see M. Neumayr und V. Uhlig: Ueber die von H. Abich im Kaukasus gesammelten Jurafossilien. p. 53. — Denkschr. der k. Akad. d. Wissensch. Math.-naturw. Classe. Bd. 59. Wien 1892.

Distribution. North-East Greenland: in the loose-lying, brownish sandstone, occurring 50 m above the sea, down from "Trækpasset" on Store Koldewey Island (1—2 spec.).

71. **Aulacostephanus (?) groenlandicus** n. sp.

Pl. XXXVII, fig. 3.

About one-quarter of a whorl of an Ammonite may perhaps, as new species, be referred to the genus *Aulacostephanus*.

The whorl is somewhat deformed by pressure; its sides seem to have been somewhat flattened and its height is a little greater than its breadth. The external side is also somewhat flattened. The whorl thus assumes an oval, slightly square-shaped section. The slope towards the umbilicus is even. The ribs disappear before they reach quite down to the umbilicus; on the edge of the umbilicus and somewhat above this they are very prominent with an indication of a sharp spine or node; at the same time they now bend somewhat forwards, decrease suddenly in size a little below the middle of the flank and course almost in a straight line over the external side. Most of these ribs dichotomize immediately above their strongest part and further, a new rib is inserted almost at the same place, so that for each rib on the umbilical edge there are about 3 ribs on the external side. In the middle of this the ribs become weaker somewhat, and an indication of a furrow is thus formed. Constrictions present. — The suture-line is not quite distinct; it seems to be somewhat strongly dentated and there is a well-marked "Suspensivlobus".

Height of the whorl 20 mm, its breadth 18 mm.

Distribution. North-East Greenland: in free-lying sandstone at the bottom of "Kløft II" on Store Koldewey Island (1 spec.).

72. **Garnieria pusilla** n. sp.

Pl. XXXVI, figs. 7, 8 and 9.

The shell compressed with slightly arched sides and a fairly narrow umbilicus. The slope towards the umbilicus short and steep. The inner whorls low and smooth with rounded external side. When the shell has reached a diameter of ca. 2·5 mm, a keel begins to appear on the external side, and at the same time the whorl becomes more and more compressed and increases greatly in height. The keel, which is finely dentated, is bounded later by a distinct spiral depression on each side. A number of fairly weak, falciform ribs now appear also, but no nodes. Further, the shell is here covered with numerous, very fine radial striae, inclined forwards very strongly on the outside; these striae reach right up to the keel. —

The suture-line slightly incised. The external lobe broad, not deep. The external saddle low, divided into two, somewhat unequal parts by a small adventitious lobe. The first lateral lobe narrow, but fairly deep, bifid or trifid. The first lateral saddle more strongly developed than the external saddle both in breadth and length, almost symmetrical. The second lateral lobe narrow with three points. The second lateral saddle low, irregularly lobed. Further, 2—3 faintly developed auxiliary lobes.

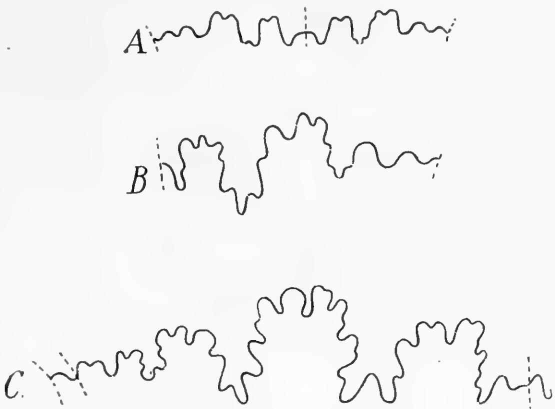


Fig. 6. The suture-line of *Garnieria pusilla* n. sp. Height of the whorl: in *A* 1·7 mm; in *B* 3 mm; in *C* 8 mm.

One of the most complete specimens has a diameter of 8·5 mm; the width of the umbilicus is 1·2 mm, height of the last whorl above the edge of the umbilicus 4·5 mm; its height above the preceding whorl 3·3 mm. The thickness could only be measured approximately; it is a little over 1·5 mm. Different fragments show, that other specimens have been not a little larger.

Distribution. North-East Greenland: in 3 black calcareous concretions found as boulders at Danmarks Havn, two from Vesterdalen, the third from a place not given (many specimens).

Indeterminable fragments or imprints of Ammonites, belonging in part at least to other species than those mentioned, were found at the following localities.

"Kløft I" on Store Koldewey Island in the calciferous and micaceous sandstone.

"4. Sænkning" on Store Koldewey Island in the loose-lying, blue-gray, calciferous sandstone.

Down from "Trækpasset" on Store Koldewey Island in a gray, calciferous and micaceous nodule of sandstone, found at a height of 50 m above the sea. — At the same locality, but above the plateau in gray cone-in-cone marl.

River-bed just to the north of Cape Oswald Heer on Hochstetter's Foreland in a light-gray, fine-grained, calcareous and very micaceous sandstone.

73. **Belemnites Panderianus** d'Orbigny.

Pl. XXXVII, fig. 2.

1842. *Belemnites excentricus* Blainv.; d'Orbigny (*pars*), Paléont. Franç. Terr. jur. I. p. 120; Pl. 17, figs. 3 and 7—8.
1845. — *Panderianus* d'Orbigny in Murchison, Verneuil et Keyserling, Géologie de la Russie d'Europe. II. p. 423; Pl. 30, figs. 1—5 and 7—11.
1881. — — d'Orb.; Nikitin, Jura von Elatma. p. 48.
1892. — *Panderi* d'Orb.; Pavlow et Lamplugh, Argiles de Speeton etc. p. 246.

Some well-preserved fragments of 3 different rostra belong with certainty to this species. — On the underside of the apex there is a well-marked furrow, which however soon becomes feebler and disappears 1·5—2 cm before the point of the rostrum, merging here gradually into the flattened underside of the rostrum; in the alveolar region the flattening disappears. Further, the hindmost part of the rostrum is greatly compressed, so that the section here is rounded-rectangular; in the alveolar region the section is more rounded-trapezoidal. The apical line lies very excentrically, especially in the posterior part of the rostrum.

The largest fragment (posterior part of rostrum) is 55 mm long and shows at its front end no trace as yet of the alveolus; the dorsoventral diameter is here 15·5 mm, the transversal 15 mm; at a distance of 29 mm from the point of the rostrum the same dimensions are respectively 13·5 and 13 mm. In a second specimen the measurements at a distance of 38 mm from the point of the rostrum are respectively 16 and 14·5 mm.

A loose-lying cast of an alveolus is present from the same locality as the above fragments of rostra; its dorsoventral angle is ca. 24°, the transversal ca. 22°. This perhaps also belongs to *B. Panderianus*.

Distribution. North-East Greenland: "Kløft I" on Store Koldewey Island (3—4 spec.).

Russia: from the zone with *Quenstedtoceras Lamberti* to the zone with *Cardioceras alternans*.

74. **Belemnites breviaxis** A. Pavlow.

1842. *Belemnites excentricus* Blainv.; d'Orbigny (*pars*), Paléont. Franç. Terr. jur. I. p. 120: Pl. 17, figs. 1—2.
1849. — — —; Quenstedt, Die Cephalopoden. p. 426; Pl. 27, fig. 5.
1865. — *abbreviatus* Phillips, British Belemnitidae. V. p. 124; Pl. 34, figs. 84—85.
1892. — *breviaxis* Pavlow et Lamplugh, Argiles de Speeton etc. p. 247; Pl. 8, fig. 7.

A fairly complete rostrum seems to belong to this species, as it agrees quite well with Pavlow's description. The extreme point with a part of the alveolar region is wanting.

The posterior part of the rostrum is distinctly compressed and the underside is flattened, so that a section here is somewhat rounded-quadrilateral with the greatest breadth down towards the underside; this section still has the rostrum in the posterior part of the alveolar region, whilst the section further forward is very nearly circular. The apical line lies very excentrically. The alveolus is very deep, as it has certainly occupied more than half of the whole length of the rostrum; its angle is ca. 22°.

The portion of the rostrum preserved is 98 mm long; at the point about 5 mm are wanting and at the alveolar end ca. 30 mm, so that the whole length has been ca. 133 mm, of which the alveolus has taken up at least 70 mm. At the point of the alveolus the dorsoventral diameter is 22·5 mm, the transversal 22 mm. The apical line lies here 7 mm from the underside and 15·5 mm from the upper side. At a distance of 35 mm in front of the point of the alveolus both the dorsoventral and transversal diameters are 23·5 mm. The width of the alveolus is here 12 mm.

Distribution. North-East Greenland: "Kløft I" on Store Koldewey Island (1 spec.).

Russia: in the zone with *Cardioceras cordatum* and *C. alternans.*

From the tenting-ground 3/V 1907 on Store Koldewey Island there are two disconnected fragments of a Belemnite, which in form and position of the axis seem to agree well with *B. magnificus* d'Orb., but the material is too incomplete for a certain determination. The fragments were found in a fine-grained, light-gray, very micaceous sandstone. The one fragment shows the posterior part of the alveolus, the angle of which is ca. 23° (measured dorsoventrally)[1]. On the surface of the same fragment there is a quantity of oblong, comparatively deep, small pits, which greatly resemble those produced by *Polydora* in Mollusc shells of the present day. These pits are filled with sandstone and must therefore have been formed before this rostrum has been deposited in the sand. — From another locality on Store Koldewey Island, the tenting-ground 8/VI 1907, there is a couple of fragments of two different Belemnite species, certainly different from those mentioned above. In the one species the rostrum is very strongly compressed and the apical line very excentric, whilst the rostrum in the other is almost circular in section with a slight flattening on the ventral side, and the apical line is considerably

[1] Zinc-blende occurs in the innermost part of the alveolus.

less excentric. — Further, from "Kløft I" on Store Koldewey Island there is the outermost end of a blunt-ended rostrum, which unfortunately is indeterminable. It lies in the usual sandstone of this locality, in which *B. breviaxis* was also found. — Lastly, at the tenting-ground 22/V 1908 (a little south of Haystack) the Expedition found a free-lying, brownish sandstone containing a very badly preserved and thus indeterminable, alveolar end of a Belemnite.

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(The treatises, marked with *, have not been accessible to me.)

INDEX.

Erratum.

Page 458, 7th line, for "Kløft II" read "Kløft I".

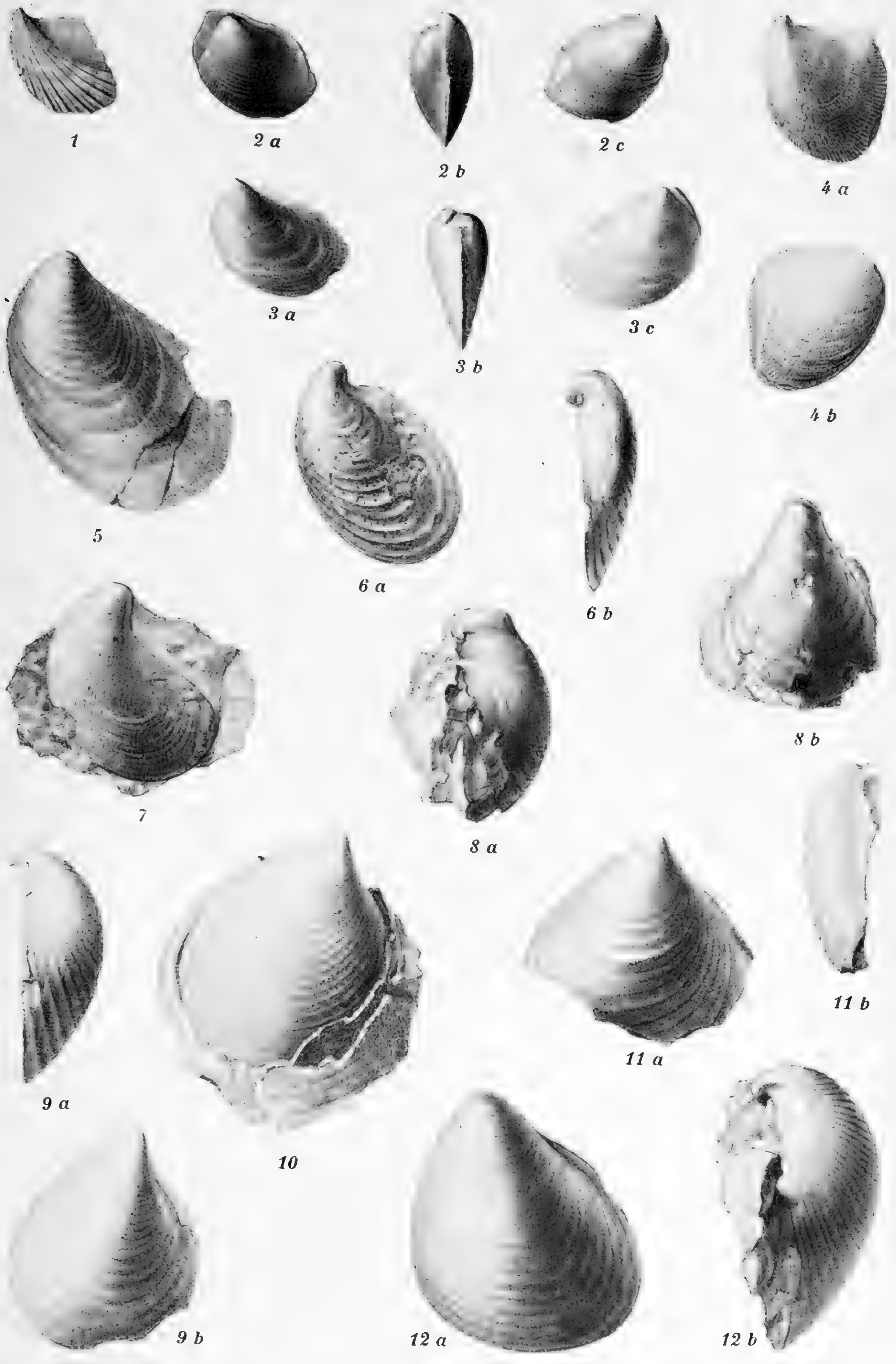
Plate XXXII.

PLATE XXXII.

Fig. 1. *Oxytoma inaequivalvis* Sow., var. *macroptera* Roem. × 2. "4. Sænkning".
— 2 a—c. *Aucella kirghisensis* Sok. "Kløft I".
— 3 a—c. — *Sinzovi* Pavl. "Kløft I",
— 4 a—b. — cfr. *reticulata* Ldgrn. Vesterdalen.
— 5. — *Bronni* Lah. "Kløft I".
— 6 a—b. — *mosquensis* v. Buch. Harefjæld.
— 7. — *tenuistriata* Lah. Vesterdalen.
— 8 a—b. — *crassicollis* Keys. Aucellabjerget.
— 9 a—b & 10. *Aucella concentrica* Fisch. Fig. 9, a left valve; Fig. 10, a right valve. Aucellabjerget.
— 11 a—b & 12 a—b. *Aucella piriformis* Lah. Fig. 11, a right valve; Fig. 12, a left valve. Aucellabjerget.

The figures are of the natural size, except where otherwise stated.

All the specimens figured are preserved in the Mineralogical Museum of the University, Copenhagen.



H. V. Westergaard del. Pacht & Crone phototyp.

Plate XXXIII.

PLATE XXXIII.

Figs. 1 a—b. *Aucella sp.*; a left valve. Aucellabjerget.
— 2—3. *Posidonomya ornati* QUENST. sp. × 2. Down from "Trækpasset".
4 & 5 a—c. *Perna groenlandica* n. sp. "Kløft I".
— 6. *Tancredia curtansata* PHILL. sp. "4. Sænkning".
— 7. *Pecten (Entolium) cingulatus* PHILL. Down from "Trækpasset".
— 8. — — *demissus* PHILL. Harefjæld.
— 9 a—b. *Modiola Strajeskiana* D'ORB. sp. "Kløft I".
— 10. *Tancredia planata* MORR. & LYC. "4. Sænkning".
— 11. *Astarte striato-costata* MÜ. "Kløft I".

The figures are of the natural size, except where otherwise stated.

All the specimens figured are preserved in the Mineralogical Museum of the University, Copenhagen.

Pl. XXXIII

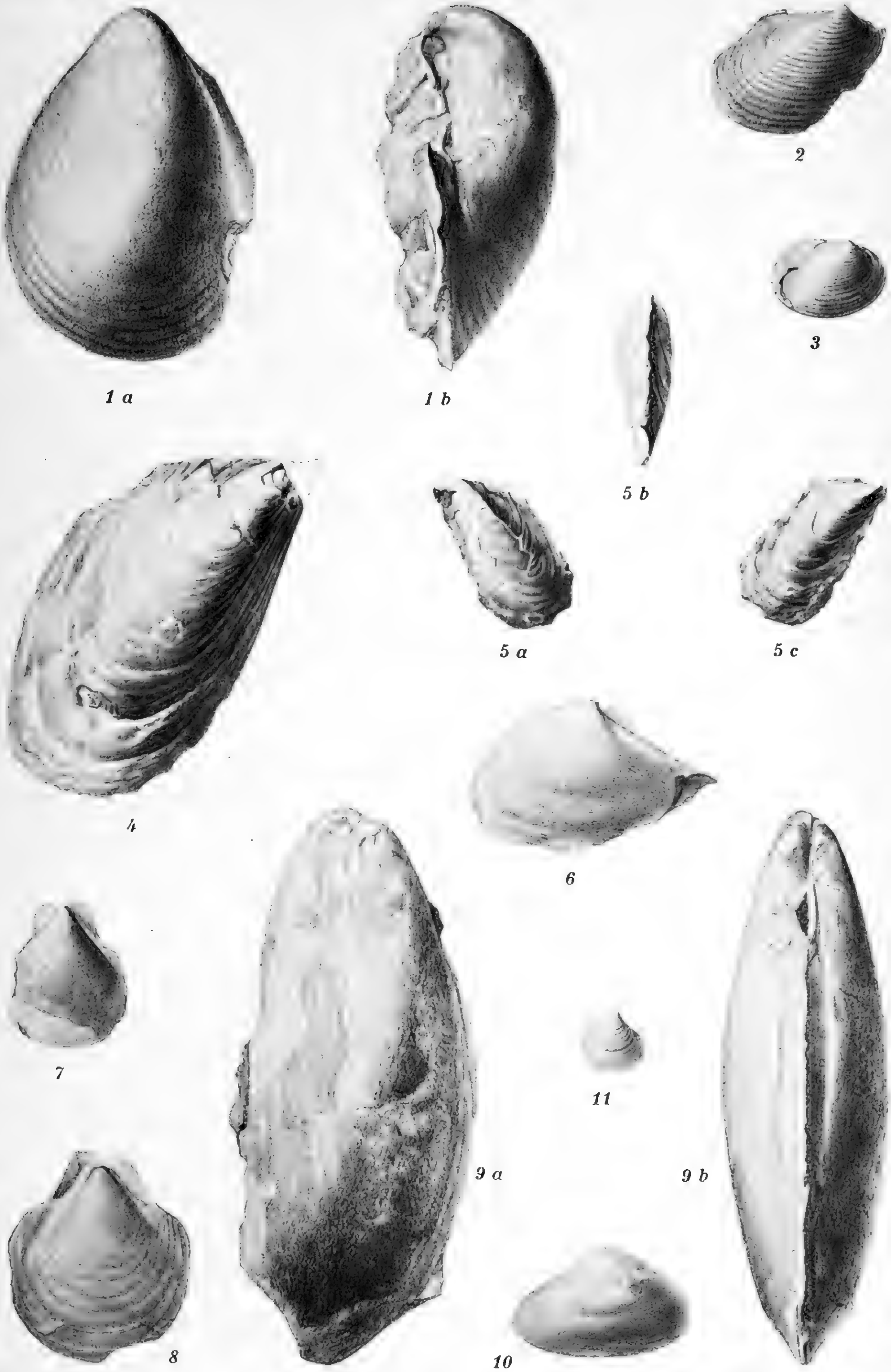


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Plate XXXIV.

PLATE XXXIV.

Figs. 1 a—c. *Macrodon Mylii* n. sp. Middle sandstone region on Store Koldewey.

— 2 a—b. *Astarte alta* n. sp. "Kløft I".

— 3 a—b & 4. *Macrodon Hagenii* n. sp. Fig. 3 a, × 3. Middle sandstone region on Store Koldewey.

— 5 a—b & 6. *Pecten (Camptonectes) Broenlundi* n. sp. Fig. 5, a left valve; Fig. 6, a right valve. "Kløft I".

The figures are of the natural size, except where otherwise stated.

All the specimens figured are preserved in the Mineralogical Museum of the University, Copenhagen.

H. V. Westergaard del. Pacht & Crone phototyp.

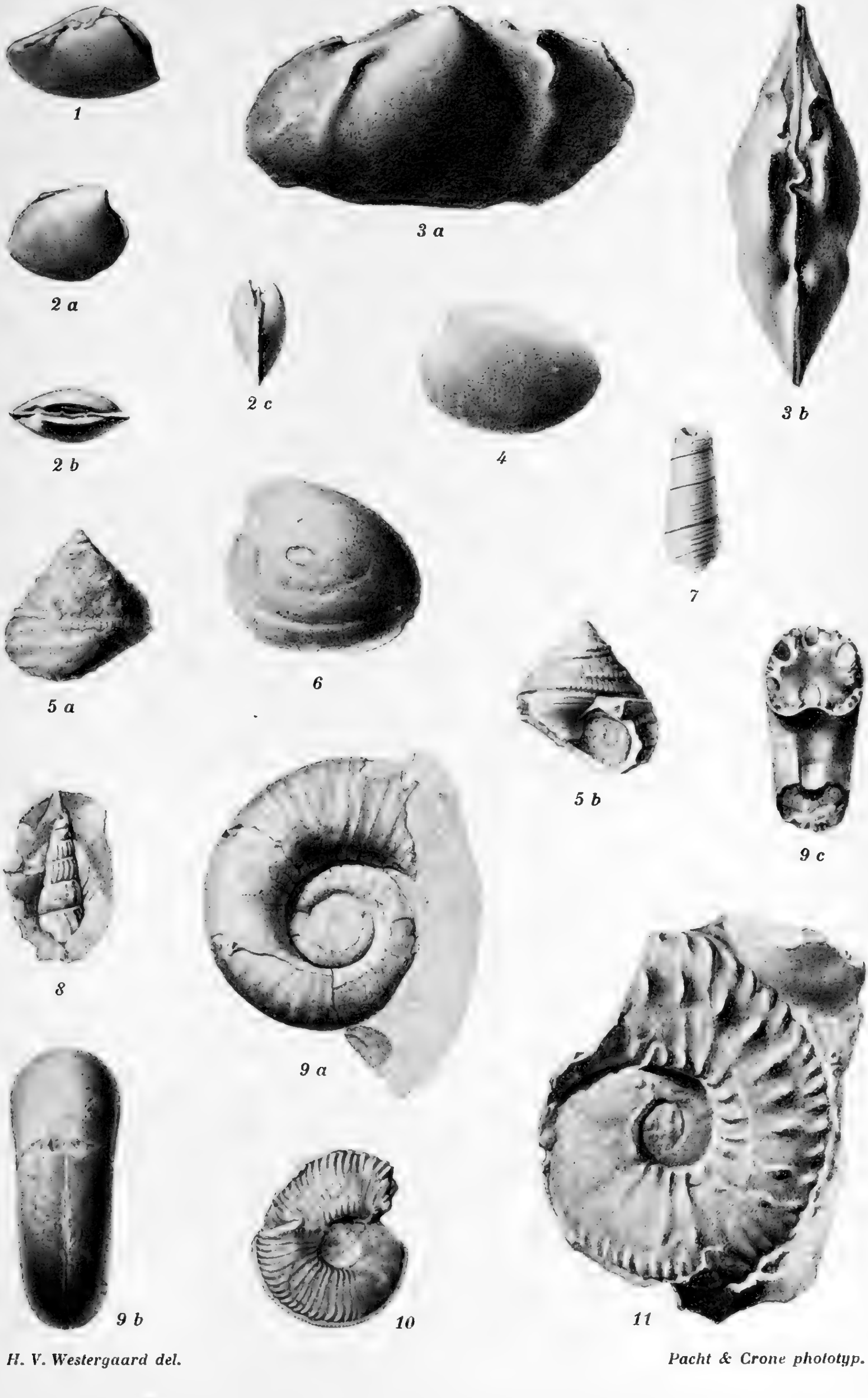
Plate XXXV.

Plate XXXV.

Fig. 1. *Tancredia axiniformis* PHILL. sp. "Kløft I".
— 2 a—c. *Cyprina* cfr. *mosquensis* D'ORB. "Kløft I".
— 3 a—b. *Tancredia Jarneri* n. sp. "Kløft II".
— 4. *Cyprina kharoschovensis* ROUILL. Top of Muschelberg.
— 5 a—b. *Amberleya groenlandica* n. sp. × 2. Down from "Trækpasset".
— 6. *Cyprina Syssollae* KEYS. "Kløft I".
— 7. *Turritella* sp. "Kløft II".
— 8. *Chemnitzia hamptonensis* MORR. & LYC. × 2. "4. Sænkning".
— 9 a—b. *Lytoceras polare* n. sp. Vesterdalen.
— 10. *Cardioceras Nathorsti* LDGRN. sp. ? "4. Sænkning".
— 11. — sp. "Kløft I".

The figures are of the natural size, except where otherwise stated.

All the specimens figured are preserved in the Mineralogical Museum of the University, Copenhagen.



H. V. Westergaard del. Pacht & Crone phototyp.

Plate XXXVI.

Plate XXXVI.

Figs. 1—3. *Cardioceras alternans* v. BUCH sp. "Kløft I".
— 4 a—c. *Quenstedtoceras* (?) sp. Down from "Trækpasset".
— 5 a—b & 6 a—b. *Cosmoceras boreale* n. sp. Down from "Trækpasset".
— 7, 8 & 9 a—c. *Garnieria pusilla* n. sp. Figs. 7 & 8, × 3; Fig. 9, × ca. 25. Vesterdalen.

The figures are of the natural size, except where otherwise stated.

All the specimens figured are preserved in the Mineralogical Museum of the University, Copenhagen.

H. V. Westergaard del. *Pacht & Crone phototyp.*

Plate XXXVII.

PLATE XXXVII.

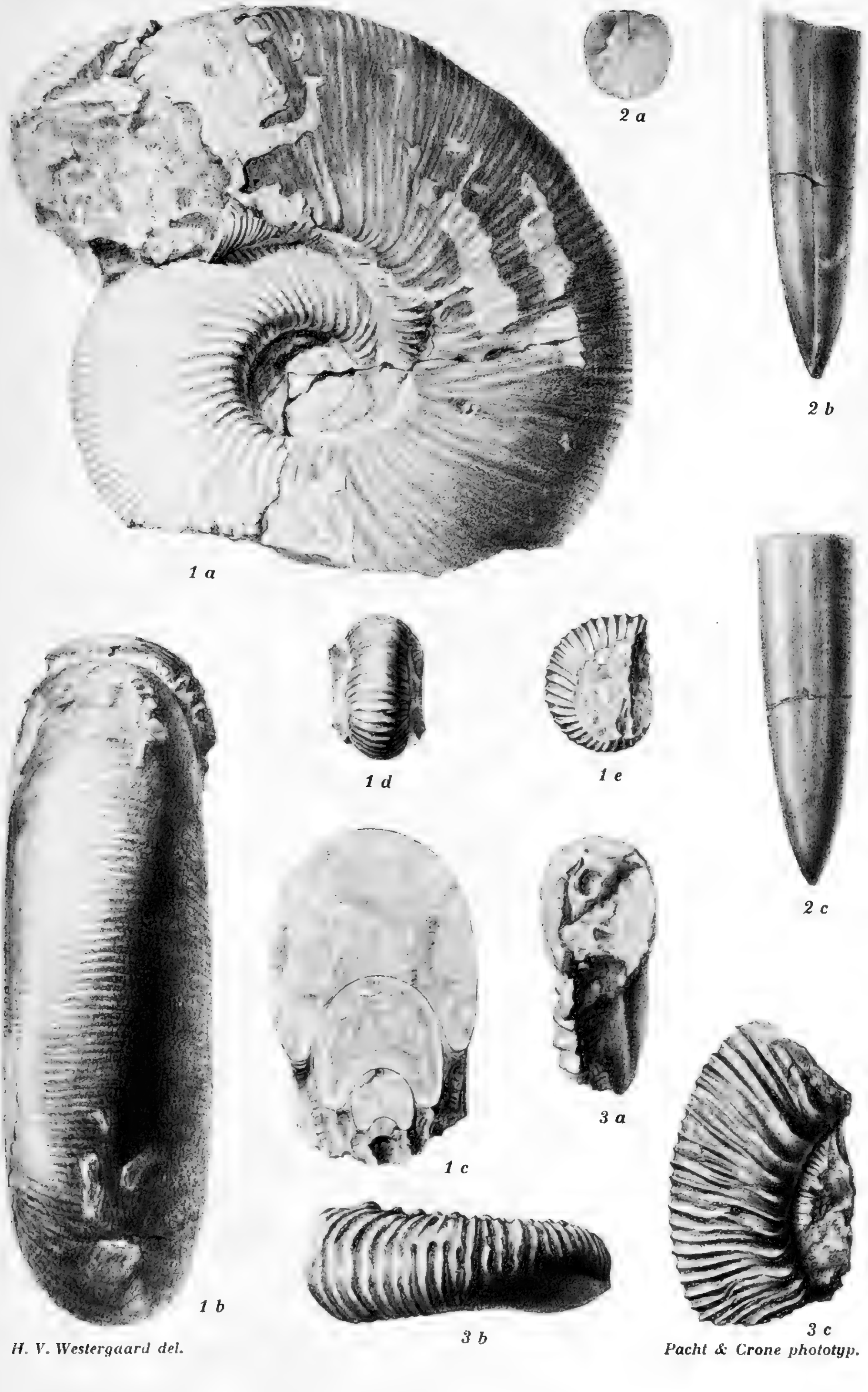
Figs. 1 a—e. *Kepplerites Tychonis* n. sp. Figs. d & e, one of the innermost whorls, $\times$ ca. $2^1/_2$. Down from "Trækpasset".

— 2 a—c. *Belemnites Panderianus* d'Orb. Fig. b, ventral view; Fig. c, lateral view. "Kløft I".

— 3 a—c. *Aulacostephanus* (?) *groenlandicus* n. sp. "Kløft II".

The figures are of the natural size, except where otherwise stated.

All the specimens figured are preserved in the Mineralogical Museum of the University, Copenhagen.



H. V. Westergaard del. Pacht & Crone phototyp.

Plate XXXVIII.

PLATE XXXVIII.

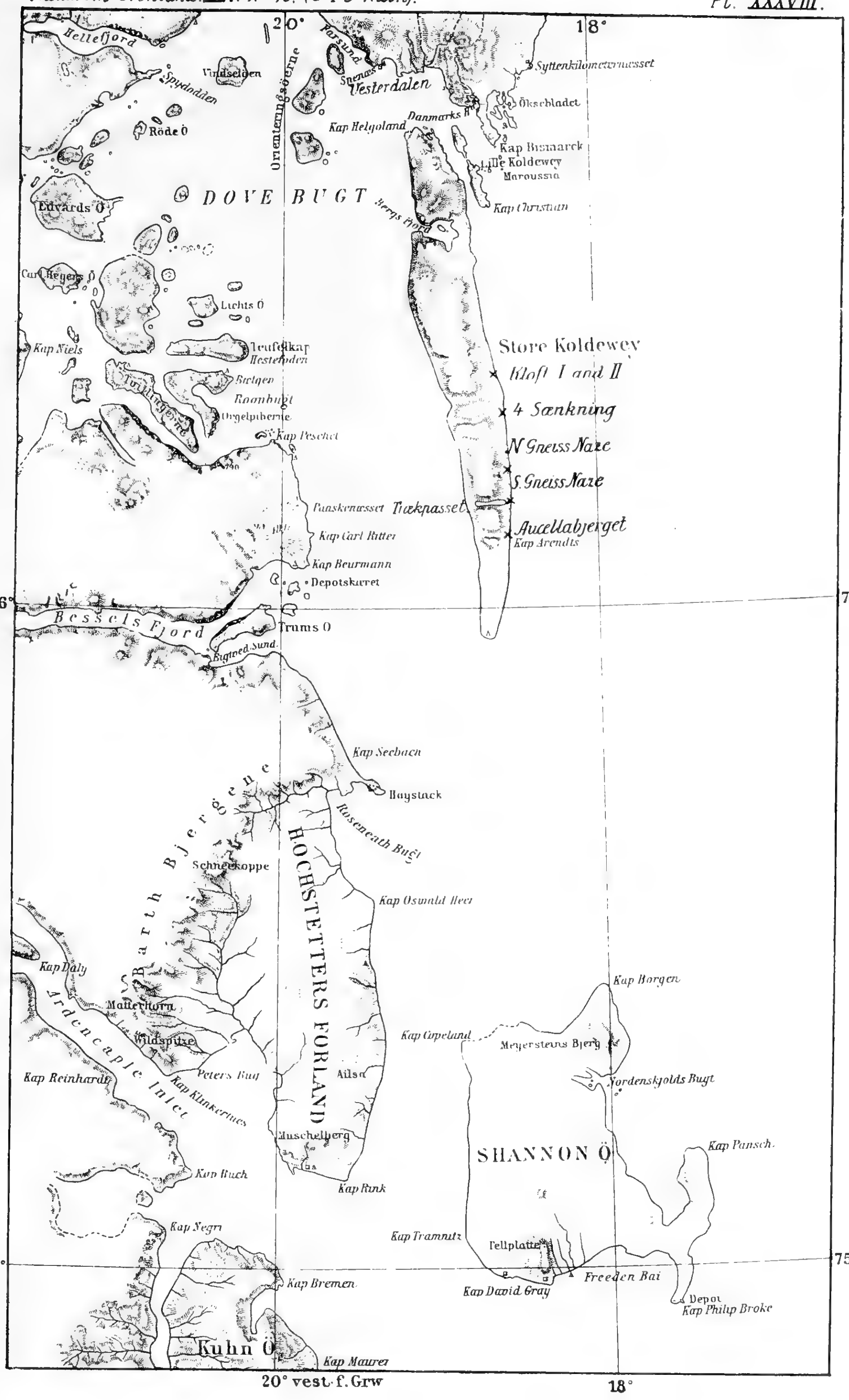
Map-sketch over a part of North-East Greenland, drawn from the map made by Capt. J. P. Koch, on which are indicated those localities, where Jurassic and Cretaceous fossils were found by the Danmark Expedition.

These localities are (from N. to S.) the following:

Germania Land: Vesterdalen.
Harefjæld, between Vesterdalen and Danmarks Havn.
Danmarks Havn.

Store Koldewey Island: Kløft I.
Kløft II.
4. Sænkning.
(Kløft I., Kløft II. and 4. Sænkning: The northern sandstone region.)
The middle sandstone region between the N. Gneiss Naze and the S. Gneiss Naze.
Down from Trækpasset. This locality belongs to the southern sandstone region.
Aucellabjerget.

Hochstetters Foreland: Muschelberg.


20°
18°
Hellefjord
Vindselden
Spydodden
Röde Ö
Orienteringsöerne
Farsund
Snenæs
Vesterdalen
Syttenkilometernæsset
Öksebladet
Danmarks H.
Kap Helgoland
Kap Bismarck
Lille Koldewey
Maroussia
Kap Christian
DOVE BUGT
Bergs fjord
Edvards Ö
Carl Hegers Ö
Lichts Ö
Kap Niels
Teufelkap
Hestefoden
Store Koldewey
Kloft I and II
4 Sænkning
N Gneiss Naze
S. Gneiss Naze
Aucellabjerget
Kap Arendts
Roonbugt
Orgelpiberne
Kap Peschel
Paaskenæsset
Trækpasset
Kap Carl Ritter
Kap Beurmann
Depotskæret
76°
Bessels Fjord
Trums Ö
Kap Seebach
Haystack
Roseneath Bugt
Schneekoppe
Barth Bjergene
HOCHSTETTERS FORLAND
Kap Oswald Heer
Kap Daly
Matterhorn
Wildspitze
Ardencaple Inlet
Kap Reinhardt
Peters Bug
Kap Klinkerfues
Ailsa
Muschelberg
Kap Rink
Kap Buch
Kap Borgen
Kap Copeland
Meyersteins Bjerg
Nordenskjolds Bugt
SHANNON Ö
Kap Pansch
Kap Negri
Kap Tramnitz
Tellplatte
75°
Kap Bremen
Kap David Gray
Freeden Bai
Depot
Kap Philip Broke
Kuhn Ö
Kap Maurer
20° vest f. Grw
18°

XI.

REPORT ON THE MALACOSTRACA PYCNOGONIDA AND SOME ENTOMOSTRACA

COLLECTED BY THE DANMARK EXPEDITION TO NORTH-EAST GREENLAND

BY

K. STEPHENSEN

1912

The present work deals with the Malacostraca, Pycnogonida and the non-pelagic, marine Entomostraca; the freshwater Entomostraca have been worked up by Dr. Vincenz Brehm (this series of Reports, Vol. 45, p. 303 et seq.; Danmark Expedition to the North-East Coast of Greenland 1906—1908, Vol. 5, No. 5, 1911), and the plankton Copepoda will be dealt with by Prof. D. Damas of Liège.

Most of the species dealt with in this work have long been known as belonging to the Greenland fauna. Nevertheless, the material has great interest in several respects, partly because the localities are the northernmost places where Crustacea have been collected in East Greenland, partly also because there are some species new for Greenland.

The species new for Greenland are the Amphipoda:

Pardalisca tenuipes G. O. Sars. Apherusa bispinosa Bate.

New for East Greenland are the following species, which were earlier known from West Greenland:

the Amphipoda:

Socarnes bidenticulatus Bate.	Monoculodes borealis Boeck.
S. Vahlii Kr.	Rhachotropis inflata G. O. Sars.
Eurytenes gryllus Mandt.	Pardalisca cuspidata Kr. (non Buchholz).
Onisimus Edwardsii Kr.	
Orchomenella groenlandica H. J. H.	Gammaracanthus loricatus Sab.

and the Tanaid Cryptocope arctica H. J. H.

Further, we have from here a hitherto undescribed, early stage of Spirontocaris (groenlandica?) and 3, likewise undescribed, developmental stages of other prawns, of which at least 2 belong to the genus Spirontocaris (p. 516 seq.).

As the material, apart from the 4 developmental stages of prawns, does not contain forms new to science, its principal importance is zoo-geographical. A summary and discussion of the new localities

in connection with those previously known will be made at the end of this work for the Malacostraca and Pycnogonida; but it may be mentioned here, that some of the species have been taken in quite shallow depths, whilst hitherto they have been known mainly from much deeper water. This applies especially to some Amphipoda, e. g. Orchomene serratus, Monoculodes tuberculatus, Syrrhoe crenulata and Halice abyssi. Orchomene serratus is stated by Stebbing (Tierreich) to live at 56—188 m.; the Danmark Expedition has taken it at 10—15 fm. Monoculodes tuberculatus has been taken at 5—10 fm.; H. J. Hansen (1895) gives from Hekla Harbour "a number of specimens, some of which from 5—12 fm.", but elsewhere the depth seems to be considerably greater: 60—70 fm. (H. J. Hansen 1887), 50—100 fm. (Sars: Account). Syrrhoe crenulata has been taken at 5—10 fm., thus the same depth as earlier given for its localities at East Greenland (5—10 fm. Buchholz, 5—9 fm. H. J. Hansen 1895), whereas in Norway it has been found at (20) 80—100 fm. (Sars: Account). — Halice abyssi was taken by the Danmark Expedition at such different depths as 10—20 fm. and 100—125 fm.; it is given from 753 m., —1.0° C, and 2030 m., —1.3° C (Sars: Norwegian North-Atlantic Expedition) and from Norway at 100—400 fm. (Sars: Account).

The species dealt with in the present work are the following:

Decapoda:	1.	Sabinea septemcarinata Sab.
	2.	Sclerocrangon ferox G. O. Sars.
	3.	— boreas Phipps.
	4.	Nectocrangon lar Owen.
	5.	Spirontocaris Gaimardii H. M. Edw.
	6.	— spinus Sow.
	? 7.	— Lilljeborgii Danielssen.
	8.	— turgida Kr.
	9.	— polaris Sab.
	10.	— groenlandica Fabr.
Mysidacea:	11.	Erythrops abyssorum G. O. Sars.
	12.	Boreomysis nobilis G. O. Sars.
	13.	Mysis oculata O. Fabr.
Amphipoda:	14.	Euthemisto libellula Mandt.
	15.	Socarnes bidenticulatus Bate.
	16.	— Vahlii Kr.
	17.	Orchomene serratus Boeck.
	18.	Orchomenella groenlandica H. J. H.
	19.	Eurytenes gryllus Mandt.
	20.	Anonyx nugax Phipps.

Amphipoda:	21.	Alibrotus littoralis Kr.
	22.	Onisimus Edwardsii Kr.
	23.	— plautus Kr.
	24.	Pontoporeia femorata Kr.
	25.	Ampelisca macrocephala Lilljb.
	26.	Stegocephalus inflatus Kr.
	27.	Paroediceros lynceus M. Sars.
	28.	Monoculodes borealis Boeck.
	29.	— tuberculatus Boeck.
	30.	— latimanus Goes.
	31.	Syrrhoe crenulata Goes.
	32.	Pleustes panoplus Kr.
	33.	Acanthozone cuspidata Lepechin.
	34.	Pardalisca cuspidata Kr.
	35.	— tenuipes G. O. Sars.
	36.	Halice abyssi Boeck.
	37.	Apherusa (Amphitopsis) glacialis H. J. H.
	38.	— megalops G. O. Sars.
	39.	— Jurinii M. Edw.
	40.	— bispinosa Bate.
	41.	Rhachotropis inflata G. O. Sars.
	42.	Halirages fulvocinctus M. Sars.
	43.	Cleippides quadricuspis Heller.
	44.	Pontogeneia inermis Kr.
	45.	Paratylus Smitti Goes.
	46.	Atylus carinatus Fabr.
	47.	Amathilla homari Fabr.
	48.	— pinguis Kr.
	49.	Gammarus locusta L.
	50.	Gammaracanthus loricatus Sab.
	51.	Ægina spinosissima Stimps.
Isopoda:	52.	Arcturus Baffini Sab.
	53.	Phryxus abdominalis Kr.
	54.	Bopyroides hippolytes Kr.
	55.	Dajus Mysidis Kr.
Tanaidacea:	56.	Cryptocope arctica H. J. H.
Cumacea:	57.	Diastylis scorpioides Lepechin.
Leptostraca:	58.	Nebalia bipes O. Fabr.
Cirripedia:	59.	Balanus porcatus Costa.
	? 60.	— crenatus Brug.
	61.	Sylon (hippolytes Kr.?).
Copepoda:	62.	Herpyllobius arcticus Stp. & Ltk.
	63.	Anchorella uncinata Müll.

Copepoda: 64. Lernæopoda carpionis Kr.
Ostracoda: 65. Philomedes globosus Lilljb.
Pycnogonida: 66. Nymphon mixtum Kr.
67. — Stroemi Kr.
68. — serratum G. O. Sars.
69. Chætonymphon hirtipes Bell.
70. Eurycyde hispida Kr.

In addition we also have the 4 developmental stages of prawns.

Regarding the abbreviations of the literature-references in the following, special part, the list of literature at the end of the paper may be consulted.

DECAPODA.

1. **Sabinea septemcarinata** Sab.

Crangon septemcarinatus Sabine, Supplement to the Appendix to Capt. Parry's Voyage 1819—20, p. CCXXXVI, Pl. 2, fig. 11—13 (1824).
*Sabinea septemcarinata Krøyer, De hidtil bekjendte nordiske Krangon-Arter; Naturh. Tidsskr. vol 4, 1842, p. 244, Pl. 4, fig. 34—40, and Pl. 5, fig. 41—44.
* — — S. J. Smith: Transact. Conn. Acad., vol 5, 1879, p. 57, Pl. 11, fig. 5 and 9—13.
— — H. J. Hansen, "Ingolf" 1908, p. 52.

St. 25. Danmarks Havn, 5—10 fm., 25—8—1997. Laminaria and Delesseria region, soft bottom. 3 spec. (50—70 mm.).
St. 49. Danmarks Havn, ca. 5 fm., 21—7—1907. Laminaria region, soft bottom. 4 spec. (45—55 mm.).
St. 62. Stormbugt, off Stormelv, 10—20 m. 20—8—1907. Laminaria region. 1 spec. (43 mm.).
St. 67. Stormbugt, 20—30 m. 29—8—1907. Delesseria region, hard bottom. 1 spec. (60 mm.).
St. 70. Danmarks Havn, 10—15 fm. 4—9—1907. Delesseria region, soft bottom. 1 ♀ with eggs, 70 mm.

2. **Sclerocrangon ferox** G. O. Sars.

Cheraphilus ferox G. O. Sars, Arch. f. Math. og Naturvid., vol 2, 1877, p. 239. —
— — Hoek, Niederl. Arch. f. Zool., Supplb. I, 1882, p. 9, Pl. 1, fig. 3.

*Sclerocrangon salebrosus G. O. Sars, Norske Nordhavs-Exp., Crust. I, 1885, p. 15, Pl. 2.
— ferox H. J. Hansen, Dijmphna-Togtets zool.-bot. Udbytte, Crust., 1887 p. 236.
— — H. J. Hansen "Ingolf" 1908, p. 49.

St. 104 b. North Polar Sea 76° 06′ N., 13° 26′ W., 125—150 m., 29—7—1908. Clay with a little gravel etc., 1 ♀ (has probably been 100 mm., but lacks part of the telson).
St. 104 b. 100—125 fm. 1 somewhat smaller specimen.

3. **Sclerocrangon boreas** Phipps.

Cancer Boreas, Phipps, Voyage towards the North Pole, 1774, p. 190, Pl. 12, fig. 1.
* — — Krøyer, De hidtil bekjendte nordiske Krangon-Arter; Naturh. Tidsskr. vol 4, 1842 p. 218, Pl. 4, fig. 1—14.
Sclerocrangon boreas H. J. Hansen, "Ingolf", 1908, p. 47.

St. 18 e. Off Eskimo ruins at 2nd tenting-ground, 0—3 fm. 24—8—1906. Mixed sand and mud with stones and algae. 1 spec. (ca. 80 mm.).
St. 18. Hvalrosodden, 0—3 fm., 24—8—1906. Littoral and Laminaria region, soft bottom. 2 small spec.
St. 18 f. Hvalrosodden, 0—2 fm. 25—8—1906. Littoral region, soft bottom. 1 spec. (ca. 15 mm.).
St. 24. Danmarks Havn, Opening in the ice at the side of the ship. 5 fm., 23—9—1006. Sand and mud with algae. 6 spec. (3 at 99, 100 and 112 mm.).
St. 25. Danmarks Havn, 5—10 fm. 25—8—1907. Laminaria and Delesseria region, soft bottom. 1 spec. (35 mm.).
St. 33. Danmarks Havn, 5 fm. 10—10—1906. Laminaria region, soft bottom. 5 spec., 1 ♀ with eggs 102, 1 ♂ 98 mm.
St. 37. Danmarks Havn, 5 fm. 10—10—1906. Opening near the ship. Sand and mud with algae. 8 spec., 1 ♂ 96 mm., 1 ♂ with eggs 109 mm.
St. 45. Danmarks Havn, 3—6 fm., 8—7—1907. Laminaria region. 2 spec. (35 and 50 mm.).
St. 46. Danmarks Havn, 4—6 fm. 15—7—1907. Laminaria region, soft bottom. 2 spec. (55 and 80 mm.).
St. 48. Danmarks Havn, 3—6 fm. 18—7—1907. Laminaria region, soft bottom. 4 spec. (3 at 55, 1 of 20 mm.).
St. 49. Danmarks Havn, ca. 5 fm. 21—7—1907. Laminaria region, soft bottom. 3 spec. (of ca. 35 mm.).

St. 56. Danmarks Havn, 5—8 fm. 28—7—1907. Boundary between Laminaria and Delesseria region. 1 spec. (30 mm.).

(No number) Danmarks Havn, July 1907. 8 spec. (70—80 mm.)

St. 58. Danmarks Havn, 0—5 fm. 10—8—1907. Littoral and Laminaria region. 1 ♀ with eggs (110 mm.).

St. 59. Danmarks Havn, 5—15 m. 14—8—1907. Boundary between Delesseria and Laminaria region. 1 spec. (15 mm.).

St. 69. Stormbugt, 10—15 fm. 2—9—1907. Delesseria region, hard bottom. 1 spec. (80 mm.).

St. 70. Danmarks Havn, 10—15 fm. 4—9—1907. Delesseria region, soft bottom. 4 small spec.

St. 72. Danmarks Havn, 5—8 fm. 11—9—1907. Laminaria region, soft bottom. 4 spec. (largest (♂) 94 mm.).

Locality not stated. 10 spec. (one of them a ♀ without eggs 96 mm.).

4. **Nectocrangon lar** Owen.

Crangon lar Owen, Zool. of Capt. Beechey's Voyage, 1838, p. 88, Pl. 28, fig. 1.

*Argis — Krøyer, De hidtil bekjendte nordiske Krangon-Arter; Naturh. Tidsskr. vol 4, 1842, p. 255, pl. 5, fig. 45—62.

Nectocrangon lar + N. dentata M. Rathbun, Harriman Alask. Exp., 1904, p. 137—138 with figs. (teste H. J. Hansen l. c.).

— lar H. J. Hansen, "Ingolf" 1908, p. 49.

St. 18 f. Hvalrosodden, 0—2 fm. 25—8—1906. Littoral region, soft bottom. 1 spec.

St. 20 b. Hvalrosodden, 3—5 fm. 19—9—1906. Laminaria region, soft bottom. 1 spec.

St. 24. Danmarks Havn, opening near the ship. 23—9—1905. Sand and mud with algae and shells. 1 spec.

St. 25. Danmarks Havn, 5—10 fm. 25—9—1906. Laminaria and Delesseria region, soft bottom. 1 spec.

St. 45. Danmarks Havn. 3—6 fm. 8—7—1907. Laminaria region. 2 spec.

St. 46. Danmarks Havn, 4—6 fm., 25—7—1907. Laminaria region. soft bottom. 1 spec.

St. 49. Danmarks Havn, ca. 25 fm. 21—7—1907. Laminaria region. soft bottom. 4 spec.

St. 65. Danmarks Havn, 5—10 fm. 25—8—1907. Laminaria and Delesseria region. 1 spec.

St. 70. 10—15 fm. 4—9—1907. Delesseria region, soft bottom. 2 spec.

Locality not stated. 1 spec.

One of the specimens from St. 70 (♀ with eggs) is 95 mm., the specimen from St. 65 (also ♀ with eggs) is 83 mm.; most are 50—60 mm.

5. Spirontocaris Gaimardii H. M. Edw.

Hippolyte Gaimardii		H. Milne-Edwards, Hist. Nat. des Crustacés, vol. 2, 1837, p. 378.
* —	—	Krøyer, Monografisk Fremstill. af Sl. Hipp. Kgl. Danske Vid. Selsk. math. naturvid. Afh., vol 9, 1842, p. 282, Pl. 1, fig. 21—29.
* —	gibba	Krøyer, ibid. p. 288, Pl. 1, fig. 30, and pl. 2, fig. 31—37.
Spirontocar. Gaimardii		H. J. Hansen, "Ingolf" 1908, p. 56.
Hippolyte	—	Appellöf, Die decapoden Crustaceen des Nordmeeres, "Meeresfauna von Bergen", Heft. 2—3, 1906, p. 122, Pl. 2, fig. 4.
—	—	Vanhöffen, 1897, p. 381, Pl. 1, fig. 4 (coloured fig.).

St. 21. Danmarks Havn, 10 fm. 20—9—1906. Sand and mud with algae. 1 ♀ with eggs.

St. 29. Danmarks Havn, 10 fm. 7—10—1906. Delesseria region, soft tom. 1 ♂ (has probably been ca. 52 mm., but lacks most of telson).

St. 46. Danmarks Havn, 4—6 fm. 15—7—1907. Laminaria region, soft bottom. 1 ♂.

St. 48. Danmarks Havn, 3—6 fm. 18—7—1907. Laminaria region, soft bottom. 3 ♂.

St. 49. Danmarks Havn, ca. 5 fm. 21—7—1907. Laminaria region, soft bottom. 1 ♀ (has probably been 62 mm., but lacks point of telson and rostrum).

St. 50. Danmarks Havn, 5 fm. 22—7—1907. Laminaria region, soft bottom. 1 ♂.

St. 60. Danmarks Havn, ca. 10 fm. 14—8—1907. Delesseria region, soft bottom. 1 ♀ with eggs. 6 ♂.

St. 71. Øresund near Koldewey Island. 15—20 fm 4—9—1907. Hydroid region, hard bottom. 1 ♂.

St. 72. Stormbugt, 8—10 fm. Delesseria region, hard bottom. 1 ♂.

(No number) Danmarks Havn, 5—10 fm. End of July 1908. Delesseria region, soft bottom. 1 with Phryxus abdominalis.

All females have no spines on 3rd caudal joint, but the males have. One male of 60 mm. from St. 60 has only a very small spine of the form figured by Appellöf, l. c. 1906, Pl. 2, fig. 4b.

6. Spirontocaris spinus Sow.

Cancer spinus	Sowerby, Brit. Miscellany, 1806, p. 47, Pl. 23.
*Hippolyte Sowerbei	Krøyer, Monogr. Fremstill. Hipp.; Kgl. Danske

Vid. Selsk. math. naturvid. Afh., vol 9, 1842, p. 298, Pl. 2. fig. 45—54.

Hippolyte spinus Hoek, Niederl. Arch. f. Zool., Supplbd. I, 1882, p. 15, Pl. 1, fig. 4—7.

— — Birula, Ann. Mus. Zool. Acad. Imp. St.-Pétersbourg, 1899, vol 1, p. 30. fig. 1.

*Spirontocaris spinus H. J. Hansen, "Ingolf" 1908, p. 58.

* — — Kemp, Decap. Natant. of Ireland. Fisheries, Ireland, Sci. Invest., 1908, I (1910), p. 103—106, Pl. 14, fig. 1.

St. 68 a. Øresund near Koldewey Island. 20—30 fm. 2—9—1907. Hydroid region, hard bottom. 1 spec.

St. 70. Danmarks Havn. 10—15 fm. 4—9—1907. Delesseria region, soft bottom. 1 ♀ with eggs, 62 mm.

? 7. **Spirontocaris Lilljeborgii** Danielssen.

Hippolyte Lilljeborgii Danielssen, Nyt Magazin f. Naturvidenskaberne, 1859 (1861), p. 5.

— securifrons Norman, Transact. Tyneside Naturalists Field Club, vol 5, 1860—62, p. 267, pl. 11, fig. 1—2.

* — Lilljeborgii Danielssen og A. Boeck, Nyt Magazin f. Naturvid., 1873, p. 196, Pl. 1, fig. 15—20.

— securifrons Birula, Ann. Mus. Zool. Acad. Imp. St.-Pétersbourg, vol 1, 1899, p. 31, fig. 2.

*Spirontocaris Lilljeborgii H. J. Hansen "Ingolf" 1908, p. 59.

* — spinus var. Lillj. Kemp, Decap. Natant. of Ireland, Fisheries, Ireland, Sci. Invest., 1908, I, (1910), p. 103—06, Pl. 14, fig. 2—10.

St. 36. Danmarks Havn, in the middle of the entrance. 6—8 fm. 13—10—1906. Sand and mud with algae, Delesseria region. 1 spec. of 21 mm., but the determination is not absolutely certain, owing to the small size of the animal and not specially good condition of preservation.

8. **Spirontocaris turgida** Kr.

Hippolyte turgida + H. Phipsii. Krøyer, Udsigt over nord. Arter Hipp., Naturh. Tidsskr. vol 3, 1841, p. 575.

* — — Krøyer, Monograf. Fremstill. Sl. Hipp., Kgl. Danske Vid. Selsk. math. naturvid. Afh., vol 9, 1842, p. 308 and 314, Pl. 2, fig. 57—58, Pl. 3, fig. 59—68.

Spirontocaris turgida, H. J. Hansen, "Ingolf" 1908, p. 61.

St. 48. Danmarks Havn, 3—6 fm. 18—7—1907. Laminaria region, soft bottom. 3 spec.
St. 49. Danmarks Havn, ca. 5 fm. 21—7—1907. Laminaria region, soft bottom. 10 spec. including 4 ♀ with eggs.
St. 50. Danmarks Havn, 5 fm. 22—7—1907. Laminaria region, soft bottom. 1 spec.
St. 60. Danmarks Havn, ca. 10—20 fm. 14—8—1907. Delesseria region, soft bottom. 1 spec.
St. 63. Stormbugt, 10—20 fm. 20—8—1907. Delesseria region, hard bottom. 1 spec.
St. 72. Stormbugt, 10—20 fm. 20—8—1907. Delesseria region, hard bottom. 3 spec.
(No number) Danmarks Havn, 5—10 fm. End of July 1908. Delesseria region, soft bottom. 9 spec., all with Phryxus abdominalis.

Most specimens are ca. 45 mm.

9. **Spirontocaris polaris** Sab.

Alpheus polaris Sabine, Suppl. to the App. of Cap. Parry's Voyage, 1824, p. CCXXXVIII, Pl. 2, fig. 5—8.
*Hippolyte — Krøyer, Monograf. Fremstill. Sl. Hipp.; Kgl. Danske Vid. Selsk. math. naturvid. Afh, vol 9, 1842, p. 324, Pl. 3, fig. 78—81, Pl. 4, fig. 82.
* — borealis Krøyer, ibid., p. 330, Pl. 3, fig. 74—77.
Spirontocar. polaris H. J. Hansen, "Ingolf" 1908, p. 63.

St. 15. 76°35′ N., 18°26′ W. ca. 75 fm. 14—8—1906. Stones with red algae. 3 spec.
St. 16b. Danmarks Havn, 5 fm. 17—8—1906. Laminaria region, soft bottom. 4 spec.
St. 18e. Hvalrosodden, 0—3 fm. 24—8—1906. Littoral and Laminaria region, soft bottom. 1 spec.
St. 20a. Danmarks Havn, 5—10 fm. 19—8—1906. Delesseria region, soft bottom. 3 spec.
St. 20b. Danmarks Havn, 3—5 fm. 19—8—1906. Laminaria region, soft bottom. 2 spec.
St. 21. Danmarks Havn, ca. 5 fm. 20—9—1906. Laminaria region, soft bottom. 4 spec.
„ „ Danmarks Havn, 10 fm. 20—9—1906. Sand and mud with algae. 2 spec.
St. 21b. Danmarks Havn, 5—10 m. 19—9—1906. Laminaria region (rock) ca. 10 spec.
St. 24. Danmarks Havn, Opening near the ship. 5 fm. 23—9—1906. Sand and mud with algae and shells. 3 spec.

St. 25. Danmarks Havn, 5—10 fm. 15—9—1906. Laminaria and Delesseria region, soft bottom. 5 spec., including 2 ♀ with eggs.

St. 27. Danmarks Havn, middle of entrance. 15 fm. 29—9—1906. Sand and mud with red algae. 7 small spec.

St. 30. Danmarks Havn, middle of entrance. 6 fm. 7—10—1906. Sand and mud with red algae and stones. 3 spec.

„ „ Danmarks Havn, middle of entrance. 6 fm. 7—10—1906. Delesseria region. 1 small spec.

St. 33. Danmarks Havn, 5 fm. 10—10—1906. Laminaria region, soft bottom. 1 small spec.

St. 35. Danmarks Havn, 5—8 fm. 11—10—1906. Laminaria and Delesseria region, hard bottom. 4 spec.

St. 36. Danmarks Havn, 5 fm. 13—10—1906. Laminaria and Delesseria region. 6 spec.

St. 45. Danmarks Havn, 3—6 fm. 8—7—1907. Laminaria and Delesseria region. 7 spec. (1 ♀ with eggs).

St. 46. Danmarks Havn, 4—6 fm. 15—7—1907. Laminaria region, soft bottom. 6 spec.

St. 48. Danmarks Havn, 3—6 fm. 18—7—1907. Laminaria region, soft bottom. 9 spec., including 2 ♀ with eggs, the one only 38 mm, from the base of rostrum to tip of telson (rostrum missing).

St. 49. Danmarks Havn, ca. 5 fm. 21—7—1907. Laminaria region, soft bottom. 4 spec., 3 ♀ with eggs.

St. 57. Danmarks Havn, ca. 10 fm. 8—8—1907. Delesseria region, hard bottom. 2 spec.

St. 57a. Danmarks Havn, 8—10 fm. 8—8—1907. Delesseria region, soft bottom. 1 spec.

St. 60. Danmarks Havn, 8—10 fm. 14—8—1907. Delesseria region, soft bottom. 4 spec.

St. 62. Stormbugt, off Stormkapelven. 10—20 m. 20—8—1907. Laminaria region. 1 ♀ with eggs.

St. 63. Stormbugt, 10—20 fm. 21—8—1907. Delesseria region, hard bottom. 8 spec., including 1 ♀ with eggs.

St. 64. Stormbugten, ca. 50 fm. 22—8—1907. Stones with “Corals”. 2 spec.

St. 65. Danmarks Havn, 5—10 fm. 25—8—1907. Laminaria and Delesseria region, soft bottom. 2 spec.

St. 66. Danmarks Havn, off Baadskær. 28—8—1907. Stones and shells with Delesseria, ca. 20 spec., including several ♀ with eggs.

(No number) Stormbugt, Stomach of a Phoca foetida ♀ of 135 cm. 21—8—1907. Parts of 4 spec.

St. 68a. Øresund, 20—30 fm. 2—9—1907. Hydroid region, hard bottom. ca. 10 spec.

St. 69. Stormbugt, 10—15 fm. 2—9—1907. Delesseria region, hard bottom. ca. 35 spec.

St. 70. Danmarks Havn, 10—15 fm. 4—9—1907. Delesseria region, hard bottom. 6 spec. including 1 ♀ with eggs.

St. 71. Øresund near Koldewey Island. 15—20 fm. 4—9—1907. Hydroid region, hard bottom. ca. 10 spec. including 4 ♀ with eggs.

St. 72. Danmarks Havn, 5—8 fm. 12—9—1907. Laminaria region, soft bottom. 6 spec.

" " Stormbugt, 8—10 fm. 9—9—1907. Delesseria region, hard bottom. ca. 30 spec., including several ♀ with eggs; one ♀ of 44 mm. lacks the spine on the lower, anterior corner of the carapace.

" " Stormbugt, between Baadskær and Vestre Havnenæs. 10—20 fm. 9—9—1907. Stones and shells with red algae. 2 spec.

St. 72a. Stormbugt, 10—50 fm. 9—9—1907. Delesseria and Hydroid region, hard bottom. 6 spec.

St. 95. Sound between Renskær and Maatten. ca. 25—50 fm. 19—7—1908. Hydroid region, hard bottom. 6 spec., 1 ♀ with eggs.

(No number) Along Cape Bismarck Peninsula. 20—7—1908. ca. 25 spec.

St. 96. Off Maroussia. 80—80 fm. 22—7—1908. Hydroid region, hard bottom. 2 spec.

Locality not stated. 7 spec., including 2 ♀ with eggs.

This species seems thus to be by far the most widely distributed Decapod in these waters. Many specimens have Phryxus abdominalis or Bopyroides hippolytes (see these, Nos. 53—54); a single specimen from St. 65 has Sylon hippolytes (No. 61).

10. **Spirontocaris groenlandica** Fabr.

Astacus groenlandicus	J. C. Fabricius, System. Entom. 1775, p. 416.
Cancer aculeatus	O. Fabricius, Fauna Groenland., 1780, No. 217, p. 239.
*Hippolyte aculeata	Krøyer, Monograf. Fremstill. Sl. Hipp.; Kgl. danske Vid. Selsk., math. naturvid. Afh., vol 9, 1842, p. 334, Pl. 4, fig. 83—98, Pl. 5, fig. 99—104.
Spirontocaris groenlandica	H. J. Hansen, "Ingolf" 1908, p. 64.

St. 18e. Off Eskimo ruins at 2nd tenting-ground. 24—8—1906. Sand and mud with stones and algae. 2 spec.

St. 20b. Danmarks Havn, 5—10 m. 19—9—1906. Laminaria region, rock. 2 spec.

St. 21. Danmarks Havn, 10 fm. 20—9—1906. Sand and mud with algae. 1 spec.

St. 24. Danmarks Havn, Opening near the ship. 5 fm. 23—9—1906. Sand and mud with algae and shells. 1 spec.

St. 30. Danmarks Havn, 6 fm. 7—10—1906. Delesseria region, soft bottom. I ♀ with eggs, 75 mm.

St. 35. Danmarks Havn, 5—8 fm. 11—10—1906. Laminaria and Delesseria region. 1 spec.

St. 36. Danmarks Havn, ca. 5 fm. 13—10—1906. Laminaria and Delesseria region. 1 spec.

St. 46. Danmarks Havn, 4—6 fm. 15—7—1907. Laminaria region, soft bottom. 1 spec.

St. 48. Danmarks Havn, 3—6 fm. 18—7—1907. Laminaria region, soft bottom. 7 spec.

St. 56. Danmarks Havn, 5—8 fm. 28—7—1907. Boundary between Laminaria and Delesseria region. 1 spec.

St. 57. Danmarks Havn, 15—20 m. 8—8—1907. Delesseria region, soft bottom. 1 spec.

St. 58. Danmarks Havn, 0—5 fm. 10—8—1907. Littoral and Laminaria region. 3 ♀ with eggs: 90 mm. (lacks tip of telson), 83, 83 mm.

St. 61. Danmarks Havn, 5—8 fm. 15—8—1907. Delesseria region, soft bottom. 1 ♀ with eggs, 90 mm.

St. 63. Stormbugt, 10—20 fm. 21—8—1907. Delesseria region, hard bottom. 1 spec.

St. 66. Stormbugt, off Baadskær. 20 fm. 28—8—1907. Stones and shells with Delesseria, S spec.

(No number) Danmarks Havn, middle of July 1907. 1 spec.

St. 69. Stormbugt, 10—15 fm. 2—9—1907. Delesseria region, hard bottom. 4 spec.

St. 70. Danmarks Havn, 10—15 fm. 4—9—1907. Delesseria region, soft bottom. 1 spec.

St. 71. Øresund near Koldewey Island. 15—20 fm. 4—9—1907. Hydroid region, hard bottom. 3 spec.

St. 72. Stormbugt between Baadskær and Vestre Havnenæs. 10—20 fm. 9—9—1907. Stones and shells with red algae. 1 spec.

St. 72. Stormbugt, 8—10 fm. 9—9—1907. Delesseria region, hard bottom. 2 spec.

St. 72. Danmarks Havn, 5—8 fm. 12—9—1907. Laminaria region, hard bottom. 2 spec.

(No number) Along Cape Bismarck Peninsula. 20—7—1908. 1 spec.

Locality not stated. 10 spec.

In addition to the adult animals, the Danmark Expedition also brought home 4 developmental stages of prawns, but, unfortunately, of each stage there is only a single, in some respects imperfect specimen. I have nevertheless thought it right to describe these specimens, as we know developmental stages of the following Greenland prawns only.

Dymas typus (Krøyer: Naturh. Tidsskrift, 3. R., vol 1, 1861, p. 63) is a Mysis stage, though we do not know to what species it belongs; in the Copenhagen Zoological Museum there are some fragments of the specimen dissected by Krøyer, but figures of them do not exist, though Krøyer writes (l. c. p. 72): "Figurae, qua ad Dymanta typum explanandum confectae sunt, cum fasciculo hujus libri proximo apparabunt".

Sclerocrangon boreas: G. O. Sars: Bidrag til Kundskaben om Decapodernes Forvandling. III. Crangonidae. Archiv f. Math. og Naturvid., 1890, p. 180, Pl. 6, figs. 14—31.

Sclerocrangon ferox: Wollebæk: Le developpement du genre Sclerocrangon. Bergens Museums Aarbog 1906, No. 11, 2 pl. — and Koelbel, Crust,, Pycnog. u. Arachn. von Jean Mayen. Die Internationale Polarforschung 1882—83. Die oesterreichische Polarstat. Jean Mayen, Beobacht. Ergebn. vol 3, 1886, p. 51, Pl. 4, figs. 1—12.

Pontophilus norvegicus G. O. Sars, l. c. 1890, p. 160, Pl. 4.

Sabinea septemcarinata G. O. Sars, l. c. 1890, p. 168, Pl. 5, pl. 6, figs 1—13. The Mysis stage is described under the name of Myto Gaimardii by Krøyer in Naturh. Tidsskrift, Ny Række, vol 1, 1844, p. 470 and 3. Række, vol 1, 1861, p. 63, 69, 73—75 and figured by Krøyer in Gaimard, Voyage en Scandinavie, Crust., 1846, Pl. 7, figs. 1; it is erroneously referred by H. J. Hansen (1887, p. 53) to *Sclerocrangon boreas.*

Spirontocaris polaris, embryo. Krøyer: Monografisk Fremstill. Sl. Hipp., Kgl. Danske Vid. Selsk. math. naturvid. Afh., vol 9, 1842, p. 245, Pl. 6, figs. 120—132.

Pandalus borealis and *P. Montagui* G. O. Sars, Account of the postembr. develop. of Pandalus borealis with remarks on the devel. of other Pandali. Report on Norwegian Fishery and Marine Invest., vol 1, 1900, No. 3, p. 6, Pl. 1—Pl. 7, figs. 1—3 and p. 23, Pl. 7, figs. 4—11, Pl. 8, figs. 1—2.

Acanthephyra purpurea Coutière, Bull. Mus. Océanogr. Monaco, No. 70, 1906, p. 12—20, figs. 5—7. — Kemp, Decap. Biscayan Plankton, XI, Transact. Linn. Soc. London, ser. 2, Zool., vol 10, 1907, part 8, p. 206, Pl. 14, Pl. 15, fig. 1.

Pasiphae tarda Björck: Bidrag till Kännedomen om Decapodernas larvutveckling, I, Passiphæa. Arkiv för Zoologi, vol 7, no. 15, 1911, p. 4—17 (with figs), 1 Pl.

Parapasiphaë sulcatifrons, Kemp 1908 (1910) p. 49—54, Pl. 5, figs. 3—21.

Gennadas elegans, Monticelli et Lo Bianco: Sullo sviluppi dei Peneidei del Golfo di Napoli; Monit. Zool. Ital., anno XI, (suppl.) Roma 1900, p. 20—28 (teste Bouvier, Rés. Camp. Sc. Monaco, vol 33, Penéidés, 1908, p. 35; the paper named is not in Copenhagen, and I have not seen it myself).

Sergestes arcticus, Wasserloos, Metam. von Serg. arct., Zool.-Anzeiger, vol 33, No. 10, 1908, p. 303, 10 figs.

The imperfection of the material is shown for example by some legs being absent, and it is often clear, that the number of the setæ cannot be given exactly as some of them are broken off. For this reason the following descriptions state nothing as a rule regarding the number of setæ, but reference may be made to the figures.

A. Early stage of Spirontocaris (groenlandica Fabr.?) (Pl. XXXIX).

St. 35. Danmarks Havn. 5—8 fm. 11—10—1906. Laminaria and Delesseria region. 1 spec., total length 10 mm.

Carapace almost cylindrical, very nearly 1/3rd of the total length. Rostrum about 1/4th as long as the dorsal line of the carapace without rostrum; over the base of the rostrum 2 small teeth behind one another. On each side of the anterior margin of the carapace 3 spines: 1 above and 1 below the eye, 1 at the lowermost corner. 1st and 2nd abdominal segments almost equally long; 3rd segment in the dorsal line almost as long as the 1st and 2nd segment together; 4th and 5th segments somewhat shorter. On the first 5 abdominal segments the epimeral plates somewhat pointed, especially on the 4th and 5th segments. 6th segment a little shorter than the 2 preceding together, almost cylindrical, with a small tooth on each side of the root of the telson. Telson (fig. 10) of the same length as the 6th segment, almost $2^1/_2$ times as long as broad, with almost parallel, but slightly convex sides. Close to the posterior corners on each side there is a small spine. The hind margin almost straight, with 5 or 6 pairs of spines (unfortunately this part is defective). On each corner there seem to be 2 small spines on the outside, and inside these a somewhat larger spine. Then comes a slightly concave part without spines, and nearest the middle line 2 or 3 pairs of spines, probably of equal length. Between the 2nd and 3rd spine from the middle line there is a fine bristle.

The eyes (fig. 2) pyriform, fairly large; the facetted portion takes up, in length, almost 1/3rd of the whole length of the eye.

1st ant. (fig. 2) consists of the usual parts. The 1st joint of the stalk has a large spine almost midway on the outer edge. The 2nd and 3rd joints almost equally long; the 2nd joint has a tooth on the outermost, anterior corner. The endopodite as long as the 2 distal joints of the stalk together; has 4 or perhaps 5 joints, the 1st joint being perhaps divided into 2 by an indistinct constriction. The exopodite has 5 thick joints and is twice as long as the endopodite.

The squama (fig. 2) has the outer margin straight, inner margin convex; the length is ca. 3 times the greatest breadth, which lies a little on the inner side of the middle. On the outer anterior corner a tooth, which reaches as far forwards as the point of the squama. Point of the flagellum wanting, so that its length cannot be given; rest of the flagellum has a free joint proximally; the remaining joints are only indicated by constrictions.

The mandibles (fig. 3) have a quite small, unjointed palp. The mastigatory part is divided into an anterior cutting part and a posterior molar process; unfortunately the point of the former is wanting. The molar process is almost wedge-shaped and has at the end a large, strong tooth and also setæ.

The 1st pair of maxillae (fig. 4) bear a palp on the outer side with the two points close together. The form of the 2 lobes of the basal part can be seen from the figure; unfortunately the point of the inner lobe is wanting.

The 2nd pair of maxillae (fig. 5) consist of the usual parts. The mastigatory part projects far forward, especially the foremost, bifurcated lobe; the hindmost lobe is not so projecting and on its anterior margin has but a small accessory lobe. The palp somewhat more slender than on mx^1 and with a constriction in the middle, but with no true articulations. The exopodite is a large, oblong plate; the front part is almost rectangular, the inner margin however somewhat concave; the hindmost section is only half as long as the front part and becomes broader out towards the end.

The 1st pair of maxillipedes (fig. 6) are much compressed like mx^2. Both the mastigatory and basal lobe are undivided and project almost equally; of spines on the hindmost lobe there remains only one, single, long spine, pointing backwards. The palp, which is longer than in the maxillae, is distinctly divided into 3 joints. The exopodite is long, bent somewhat inwards and has 3 pairs of ciliated setæ at the tip. The epipodite is large and has a constriction a little in front of the middle.

The 2nd pair of maxillipedes (fig. 7) consist of the same parts as mxp^1, but the palp is developed at the expense of the remainder. In contrast to mxp^1 there is a distinct articulation between the 2

joints of the stalk, and there seem to be no setæ on the 1st joint, the inner margin of which is drawn backwards in relation to the margin of the 2nd joint. Of the 5 joints of the palp the 4th is by far the largest, whilst the 5th joint is quite short, but broad; both joints have numerous stiff setæ. The exopodite, which is attached to the 2nd joint by means of a true articulation, is fairly large, but does not seem to have borne natatory setæ. The epipodite is quite small.

The 3rd pair of maxillipedes (fig. 8) resemble a pair of pereiopoda; there is a short, unjointed exopodite and a trilobed endopodite. The latter has the same form and hairiness as in the adult species of the genus *Spirontocaris.*

Of the pereiopoda (fig. 8) the 4th and 5th pairs are wanting; p_1, p_2 and p_3 have a form quite similar to that in the adult *Spirontocaris,* but the 5th joint on p_3 is divided into 3 joints, whilst in the adult it usually has 7 joints.

The pleopoda (1st—5th pairs) (fig. 9) have the ordinary, bifurcated form. The endopodite and exopodite are lancet-like and bear ciliated setæ; on its inner side the endopodite has a small, articulated branch. The 1st pair are much shorter than the others.

In the uropoda (fig. 10) the two branches are almost equally long, but somewhat shorter than the telson. The exopodite is very nearly elliptical-lancet-shaped with a small tooth on the outer margin; the endopodite is lancet-shaped.

To judge from the form of the 3rd pair of maxillipedes and the pereiopoda there can be no doubt, that this is a young stage of a *Spirontocaris* species. The pointed epimeral plates on the 1st—5th abdominal segments point to *Spirontocaris groenlandica;* this species has exactly the same number of spines on the anterior margin of the carapace as the example described.

B. Early stage of a Spirontocaris (Pl. XL—XLI).

St. 57. Danmarks Havn, 15—20 m. 8—8—1907. Delesseria region, soft bottom. 1 spec. Total length 13 mm.

The whole animal very soft and swollen, so that the figure of the habit (fig. 11) is possibly not quite accurate; the first 3 abdominal segments are so swollen, that it was quite impossible to draw them.

The carapace with rostrum somewhat more than 1/3rd of the length of the whole animal. Rostrum not specially pointed, 1/4th as long as the carapace without rostrum. The rostrum has no teeth; on each side, on the other hand, there is a small tooth above and below the eye and on the lower, anterior corner of the cara-

pace. The 4th and 5th abdominal segments almost equally long; the epimeral plates on the 4th segment rounded, on the 5th segment pointed. The 6th segment very nearly the same length as the 4th and 5th together; on each side posteriorly it has a small tooth at the root of the telson. The telson (fig. 20) almost as long as the 6th abdominal segment; the breadth decreases evenly towards the point, where it is almost 2/3rds as broad as at the root. On the lateral margin of the telson are 2 pairs of small spines; on the slightly convex, posterior margin 4 pairs, the outermost pair quite small; between the 2nd and 3rd pair (from the middle) a thin bristle, between the 1st and 2nd pair two thin bristles. The eye (fig. 12) large; the facetted portion occupies almost the half of the whole length of the eye (apart from the thin part of the stalk).

In the 1st pair of antennæ (fig. 12) the endopodite is somewhat shorter than the stalk and consists of 7 joints, which decrease in length out towards the tip; the 4 proximal joints have signs of articulation in the middle. The exopodite has proximally 6 thick joints, which together are a little shorter than the endopodite, and outermost 3 thin joints; the covering of setæ is seen in the figure.

The squama (fig. 12) is oblong, with straight outer margin and somewhat convex inner margin; in the middle where the breadth is greatest this it almost 1/6th of the length. The tip is rounded and the dentiform projection does not reach quite so far forward as the tip. The length of the flagellum cannot be given, as the tip is wanting; but proximally it consists of a single, thick joint, then of a series of very short joints, which are ca. 4 times as thick as long, and distally of a thin part, the segments of which are as long or a little longer than their thickness.

The mandibles (fig. 13) have a palp and bilobed mastigatory part. The front part, the cutting part, is a little bent and compressed with 4 teeth. The molar process is a little longer than the cutting part, almost cylindrical and along the edge has a number of closely placed, dark-brown teeth, the series of which is interrupted in the under margin of the mandible. The palp almost as long as the cutting part and with a constriction almost in the middle, so that there is an indication of 2 joints.

The 1st pair of maxillae (fig. 14) have the typical form with palp and bilobed basal part. The form and setæ can be seen from the figure, but it may be remarked, that the two points of the palp, just as in the previously described stage of *Spirontocaris groenlandica,* are not above one another but side by side.

The 2nd pair of maxillae (fig. 15) have almost the same form as in the stage A (fig. 5), but the hinder portion of the mastiga-

tory part has not a small, separate, anterior part, as is usually the case, but this is perhaps an abnormality in the specimen figured. The palp is large, two-jointed. The hindmost part of the exopodite is almost as long as the front part.

The 1st pair of maxillipedes (fig. 16) resemble those of stage A (fig. 6), but there are more setæ on the basal lobe and at the base of the exopodite; the palp is smaller and has only a constriction, not distinct joints.

On the other hand, the 2nd pair of maxillipedes (fig. 17) differ to a greater extent from stage A (fig. 7). The 2nd joint of the stalk is almost twice as long as broad and the bend in the palp takes place not at the 4th but at the 3rd joint. The exopodite is long and thin and has 5 ciliated setæ.

The 3rd pair of maxillipedes (fig. 18) are quite similar to stage A (fig. 8), except that there is no exopodite and the stalk seems to consist of only one joint.

Of the pereiopoda (fig. 18) the 1st and 4th pairs (3rd and 5th pairs wanting) greatly resemble the corresponding pereiopoda in stage A (fig. 8), though the length of each of the joints is a little different. In the 2nd pair however we find a different condition, the right and left legs not being the same. In form the right leg resembles that of the adult *Spirontocaris*, the 5th joint however being only divided into 4 rings; but the left leg is almost twice as long and has this joint divided into 5 rings.

Of the pleopoda the 1st—5th pairs (fig. 19) also have the same form as in the previously described stage (fig. 9), but the 6th pair (fig. 20) is just as long as the telson. The stem-joint has a small tooth on the outer side. The exopodite has almost parallel sides but is a little narrower at the base and is roundedly pointed at the tip; on the outer corner there is a small tooth, from which a furrow runs in some distance on the plate. The whole of the outer margin in from the tooth is densely beset with short, fine setæ. The length is almost 5 times the greatest breadth. The endopodite is elongated, lancet-shaped, broadest at the proximal 1/5th.

Regarding the development of *Spirontocaris* we have hitherto known nothing, it is true, except the embryo of *Sp. polaris* (see above p. 515) and a Mysis stage which was referred by Claus to this genus (Claus: Zur Kenntnisse d. Malacostracenlarven, Würzburger naturwiss. Zeitschr., vol. 2, 1861, p. 40, Pl. 3, fig. 8); but the form of the 3rd pair of maxillipedes and the pereiopoda permit of no doubt. Only the 2nd pair of pereiopoda, with the great difference in length between the right and left legs, remind one of the genus *Pandalus*, but this character, at least provisionally, must be taken as an abnormality. The present specimen is older than the stage A.

If we take it as certain that the specimen belongs to the genus *Spirontocaris*, the next question is of the species, and the only good character for the dermination of this seems to be the spines on the front margin of the carapace. The East Greenland species with 1 spine above each eye are *S. groenlandica* and *S. polaris;* but because this stage only has 1 spine, it can scarcely be taken for granted, that the adult will not have 2. East Greenland species with 2 spines above each eye are *S. Lilljeborgi*, *S. spinus* and *S. turgida*. The specimen may thus belong to one of these 5 species; *S. groenlandica* must probably be excepted, however, as the epimeral plates on the abdominal segments are not pointed.

C. Early stage of a Spirontocaris (Pl. XLII).

St. 27. Danmarks Havn, 10—15 fm., 29—9—1906. Delesseria region, soft bottom. 1 spec. Total length 9 mm.

Carapace almost cylindrical (fig. 21), between 1/3 and 1/4th of tbe total length of the animal. Rostrum very short, without teeth. Above the eye a fairly large spine; below the eye, however, and on the lower, anterior corner of the carapace the spines are just indicated. The 1st and 2nd abdominal segments almost equally long and very nearly of the same length as the 4th and 5th segments. The 3rd segment in the dorsal mid-line is twice as long as the other segments and is greatly drawn out posteriorly. The epimeral plates on the 1st—5th segments rounded. The 6th segment twice as long as the preceding, almost cylindrical. The telson (fig. 30) of equal length with the 6th segment, with slightly convex sides and at the tip about $1^{1}/_{2}$ times as broad as at the base. On each side close to the hinder corner is a small spine; on each corner 1 somewhat larger and on the posterior edge 3 pairs of considerably larger spines; there is a comparatively great distance between the outermost and the next pair of spines.

The eyes (fig. 22) have almost the same form as in the stages A and B (figs. 2 and 12).

The squama (fig. 22) has almost the same form as in the stage A (fig. 2), but the front edge is somewhat more evenly cut, so that the teeth come to project more forwards. The portion of the flagellum preserved is formed of quite distinct joints.

In the 2nd pair of antenna (fig. 22) the outer edge of the first 2 joints of the stalk ends in a tooth. The endopodite short, three-jointed; the exopodite somewhat longer, six-jointed.

The mandibles (fig. 23) want the palps. Of the mastigatory part the end of the cutting part has 2 large proximally to them 2 quite small teeth. The molar process is a little longer and along the edge

has several rows of closely placed, small teeth, but with a break in the middle on each side.

The 1st pair of maxillae (fig. 25), in the undivided posterior portion of the mastigatory part, resemble more stage B (fig. 15), but the palp is unjointed though it has a constriction in the middle and the front part of the exopodite is more rounded anteriorly, whilst the hindmost part is very short.

The 1st pair of maxillipedes (fig. 26) take up an intermediate position between stage A and stage B (figs. 6 and 16); the palp is divided into 3 parts by constrictions, but has no true articulations; the epipodite has no notch on the outer edge.

The 2nd pair of maxillipedes (fig. 27) have a great resemblance to stage A (fig. 7); the principal difference seems to be, that the exopodite is a little longer and narrower, and that it has the remains of 3 ciliated setæ at the tip.

The 3rd pair of maxillipedes and the pereiopoda (figs. 28, 29) have such an obvious resemblance to the two other stages (figs. 8 and 18) that they require no further description; the break on the 3rd joint of the 3rd pair of maxillipedes does not seem to be natural.

The 1st - 5th pairs of pleopoda have the same form as in the other stages (figs. 9 and 19). Of the uropoda (fig. 30) only the endopodite is complete; it is much shorter than the telson. The end of the exopodite is wanting.

The great resemblance with the two preceding stages leaves no doubt possible, that this specimen also belongs to the genus *Spirontocaris;* in age it seems to come nearest to stage A. The principal difference from the two other specimens seems to be the absence of palps on the mandibles.

D. Mysis stage of a Spirontocaris (?). (Pl. XLIII.)

St. 77. Danmarks Havn, 0—20 m. 13—9—1907. 1 spec.

The carapace (fig. 31) is about 1/3rd of the whole length of the animal; it is very nearly cylindrical. Rostrum long and thin, 1/3rd of the length of the carapace without rostrum, somewhat shorter than the eyes; a little behind the base of the rostrum there is a small tooth on the back of the carapace. Above each eye a fairly large spine, below the eye and on the lower, anterior corner of the carapace a small projection. 1st and 2nd abdominal segments almost equally long (the 2nd however the longer); the 3rd segment equal to the 1st and 2nd together; the 4th and 5th of the same length as the 2nd and with a strong spine almost midway on each side of

the posterior margin. 6th segment between 2 and 3 times as long as the 5th and ending posteriorly with a tooth on each side of the root of the telson. Telson (fig. 39) a little shorter than the 6th abdominal segment, at the end almost $1^1/_2$ times as broad as the root; a small spine on each side almost opposite the beginning of the distal 1/5th. On the posterior margin 7 pairs of setæ; as several of these unfortunately lack the tip, their length cannot be given with certainty, but the outermost are slightly shorter than the middlemost.

The eyes are of the usual pyriform shape and are almost half as long as the carapace. The 1st pair of antennae (fig. 32) have a three-jointed stalk and two still undivided branches. The first joint of the stalk is twice as long as the 2nd and 3rd together; about halfway along the outer margin there is a large tooth. The 2nd and 3rd joint almost equally long; at the end of the 2nd joint a tooth on the outer side. The endopodite half as long as the exopodite; the latter has the thick form usual in the larvae, with 5 bundles of setæ on the inner side, corresponding to the ends of the joints which appear later.

The squama (fig. 32) has the same length as the 1st pair of antennae, has almost the same breadth everywhere and is very nearly 4 times as long as broad; the end is rounded and bears a strong tooth. In the flagellum the first joint is distinctly separated; the remaining part of the flagellum only has indications of a series of small, short joints.

The labrum (fig. 33) has the usual, slightly bifurcate form.

The mandibles (fig. 34) have no palp. The mastigatory part has the ordinary bilobed form. The front portion, the cutting part, has 3 teeth, and between it and the molar process project long, thin teeth.

The 1st pair of maxillae (fig. 35) have the 1st joint of the stalk pointed triangular, the 2nd joint broadly rounded at the end. The palp has 3 setæ at the tip, 2 on a tubercle on the inner margin.

In the 2nd pair of maxillae (fig. 36) the 4 lobes of the basal part are not alike; the innermost is almost rectangular at the end, the 2nd pointed triangular, 3rd and 4th rounded; the anterior seta on the 3rd and 4th lobe is situated on a special, small tubercle. The palp flat, pointed triangular, with indications of division into 5 joints. The exopodite somewhat longer than the palp; the point is rounded triangular with slightly concave inner side. The posterior lobe small.

The 1st pair of maxillipedes (fig. 37) consist of the usual 3 parts. The basal part broad, flat, instinctly divided into 2 portions, with

a small, oval epipodite on the outer side. The endopodite seems to be divided into 4 parts but is not jointed in reality. The exopodite is a little longer than the endopodite and ends in 3 (?) pairs of natatory setæ.

The 2nd and 3rd pairs of maxillipedes (fig. 37) have exopodites, which are very nearly twice as long as that on the 1st pair, but much heavier and seem to be the true swimming apparatus of the animal; they each have 8 (?) pairs of natatory setæ. Both the mentioned appendages have a thick, two-jointed stalk; there is no epipodite, but this is probably due to the imperfect condition of the animal. The 5 joints in the 2nd pair of maxillipedes are almost equally long except the 4th joint, which is twice as long as the others. The endopodite of the 3rd pair of maxillipedes is twice as long as that of the 2nd pair; the 1st, 3rd and 5th joints are almost equally long, the 2nd joint twice as long, the 4th joint 3 times as long.

The pereiopoda (fig. 37) have the usual 7 joints and epipodite, the first 2 pairs also exopodite and end in chelæ. The exopodites are rather short, but little more than half as long as the endopodite. The comparative lengths of the joints can be seen from the figure. The 2nd pereiopod is somewhat longer than the 1st pair. The 3rd and 5th pairs of pereiopoda have the same length as the 3rd pair of maxillipedes; the distal joint has a small tooth on the inner side.

The 1st—5th pairs of pleopoda (fig. 38) have almost the same form as in the previously described stages, but there are no setæ along the margin and the small projection on the endopodite is not jointed; it is not present on the 1st pair.

In the uropoda (fig. 39) the exopodite is of the same length as the telson, the endopodite a little shorter; they are both lancet-shaped.

To judge from the form of the pereiopoda there would seem to be no doubt, that this animal also belongs to the genus *Spirontocaris;* this is further indicated by the chelæ on the 1st and 2nd pairs and also by the small tooth on the inner side of the distal joint on the 3rd—5th pairs; the adult namely has 6—7 of these teeth.

11. **Erythrops abyssorum** G. O. Sars.

Erythrops abyssorum G. O. Sars: Nyt Magazin f. Naturvid., vol 16, 1869, p. 326.

* — — G. O. Sars: Monografi over Norges Mysider. Oversigt over Norges Crust. I. Christiania Vid. Selsk. Forh. 1882, p. 36, Pl. 5, fig. 1—12.

— — Zimmer: “Fauna arctica”, vol 3, 1904, p. 448.

*Erythrops abyssorum Zimmer: Nordische Schizopoden, Nordisches Plankton, vol 6, 1909, p. 78 (with figs.) (fig. 149 is wrong).
— — H. J. Hansen, "Ingolf" 1908, p. 105.

St. 9. 76°08′ N., 10°49′ W. Mud, 300 m. 4—8—1906. 1 specimen.

12. **Boreomysis nobilis** G. O. Sars.

Boreomysis nobilis G. O. Sars. Archiv f. Math. og Naturvid. vol 4, 1879, p. 428.
* — — G. O. Sars, Norske Nordhavs-Exp., Crust. I, 1885, p. 54, Pl. 5, fig. 22—28.
— — Ohlin, Bihang Kgl. Svenska Vet. Akad.s Handl., vol 27, 1901, Afd. IV, No. 8, p. 70, fig. 3.
— — Zimmer, "Fauna arctica", vol 3, 1904, p. 433 (Lille-Karajakfjord is erroneonsly given as E.-Gr. is W. Greenland).
* — — Zimmer, Nordische Schizopoden. Nordisches Plankton, vol 6, 1909, p. 56 (with figs.).
— — H. J. Hansen, "Ingolf" 1908, p. 101.

St. 99. 77° N., 17½° W. 150 fm. 22—7—1908. Mud and gravel. 1 spec.

13. **Mysis oculata** O. Fabr.

Cancer oculatus O. Fabricius, Fauna Groenlandica, 1780, p. 245.
— — O. Fabricius, Kgl. Danske Vid. Selsk. Skrifter, Ny Samling, vol 1, 1781, p. 565, fig. 2, A-B.
Mysis oculata Krøyer, Voyage en Scandinavie, Crust., 1846, pl. 7, figs. 2—3.
* — — G. O. Sars, Monografi over Norges Mysider. Oversigt over Norges Crust. I. Christiania Vid. Selsk. Forh., 1882, p. 69, Pl. 31.
— — Zimmer, "Fauna arctica", vol 3, 1904, p. 461 (Hekla Havn is in E. Greenland, not W. Greenl.).
* — — Zimmer, Nordische Schizopoden, Nordisches Plankton, vol 6, 1909, p. 160 (with figs.).
— — H. J. Hansen, "Ingolf" 1908, p. 114.

St. 16 a. Danmarks Havn. 17—8—1906. Surface; surface-temp. ÷ 0.5° C. Many hundreds (ca. 225 cm.[3]).

St. 18 e. Opposite the Eskimo ruins at the 2nd tenting-ground. 0—3 fm. 24—8—1906. 4 spec.

„ „ Opposite the Eskimo ruins at the 2nd tenting-ground. 0—2 fm. 26—8—1906. 2 spec.

St. 18 h. Hvalrosodden, 0—4 fm. 1—9—1906. Littoral and Laminaria region, soft bottom. 1 spec.
St. 20 a. Danmarks Havn, 5—10 fm. 19—9—1906. Delesseria region, soft and hard bottom. 1 spec.
St. 20 b. Danmarks Havn, ca. 5 fm. 19—9—1906. Laminaria region, hard bottom. 3 spec.
St. 21. Danmarks Havn, 5 fm. 20—9—1906. Laminaria region, soft bottom. 1 spec.
St. 23. Danmarks Havn, 0—5 fm. 22—9—1906. Littoral region, sand and mud with algae and gravel. 3 spec.
St. 35. Danmarks Havn, 5—8 fm. 11—10—1906. Laminaria and Delesseria region, hard and soft bottom. 1 spec.
St. 48. Danmarks Havn, 4—6 fm. 18—7—1907. Laminaria region, soft bottom. 1 spec.
St. 51. Danmarks Havn, 3—5 fm. 23—7—1907. Laminaria region, soft bottom. 1 spec.
St. 56. Danmarks Havn, 5—8 fm. 28—7—1907. Boundary between Laminaria and Delesseria region. 7 spec.
St. 57. Danmarks Havn, 8—10 fm. 8—8—1907. 3 spec.
St. 59 b. Danmarks Havn, 3—8 fm. 14—8—1907. Boundary between Laminaria and Delesseria region. 10 spec.
„ „ Danmarks Havn, 5—8 fm. 14—8—1907. Laminaria and Delesseria region, soft bottom. 1 spec.
(No number) Danmarks Havn, 25—9—1907. 1 spec.
„ Danmarks Havn, 5—10 fm. End of July 1908. Delesseria region, soft bottom. 2 spec.

Many of the specimens bear *Dajus Mysidis* (see No. 55).

14. **Euthemisto libellula** Mandt.

Gammarus libellula Mandt, Observ. in hist. nat. et anat. compar. in itin. Groenl. factæ, 1823, p. 32.
Euthemisto libellula Bovallius, Arctic and Antarct. Hyper., Vega-Expeditionens vetenskapl. Iaktt., vol 4, 1887, p. 569, Pl. 46, fig. 90—96.
* — Nordenskiöldii Bovallius, ibid., p. 570, Pl. 47, fig. 104—110.
— libellula G. O. Sars: Account, vol 1, 1895, p. 13, Pl. 6, fig. 1.

St. 3. 68°24′ N., 9°42′ W. Surf. 26—7—1906. Many small specimens.
St. 17. Stormkap, 0—1 fm. 18—8—1908. On the margin of the beach. 2 small spec.
St. 39. Stormbugt, ca. 50 fm. 5—1—1907. "Coral" bottom, hard bottom. 1 medium-sized spec.

St. 85. "Store Belt". Surface below ice, thickness of ice ca. 1.5—2 m. depth of water 150—400 m., 23—3—1908. ca. 15 small spec.

St. 90. "Store Belt". Surface below ice, thickness of ice ca. 1.6 m. depth of water 357 m. 8—6—1908. 4 small spec.

St. 102. Polar Sea $78^1/_2°$ N., 14°10′ W. 220—325 m. below surface; depth of water 400 m. 24—7—1908. 1 large spec. (30 mm.).

Even the small specimens (ca. 10 mm. or less) are easy to determine by means of the form and hairy covering of the distal joint of the 3rd pair of pereiopods.

15. **Socarnes bidenticulatus** Bate.

Lysianassa bidenticulata	Sp. Bate, On some new Gen. and Sp. of Crust. Amphip., Ann. Mag. Nat. Hist., ser 3, vol 1, 1858, p. 362.
*Socarnes bidenticulatus	G. O. Sars, Norske Nordhavs-Exp., Crust. I, 1885, p. 139, Pl. 12, fig. 1.
— —	Vanhöffen 1897, p. 203, Pl. 1, fig. 2 (col. fig.).
— —	Stebbing, Tierreich 1906, p. 56.

St. 25. Opening in middle of Danmarks Havn. 10 fm. 25—9—1906. Sand and mud with red algae. 1 spec.

St. 29. Danmarks Havn, ca. 10 fm. 7—10—1906. Delesseria region, soft bottom. 2 spec.

St. 37 b. Danmarks Havn, 10 fm. 14—10—1906. Sand and mud with algae. 4 spec.

St. 50. Danmarks Havn, 5 fm. 22—7—1907. Laminaria region, soft bottom. 1 spec.

St. 57. Danmarks Havn, 15—20 fm. 8—8—1907. Delesseria region, soft bottom. 1 spec.

St. 70. Danmarks Havn, 10—15 fm. 4—9—1907. Delesseria region, soft bottom. 1 spec. New for East Greenland.

Regarding the colour Sars writes (l. c., p. 141): "the colour of the living animal was not closely observed. In the approximating species *S. Vahlii*, it is very beautiful and conspicuous". Stebbing (Tierreich) says nothing about the colour, but to judge from a coloured drawing made by Frits Johansen from a living specimen, it resembles Krøyer's description of the colour of *S. Vahlii*; it is yellowish-orange with fine red spots, the eyes black. Vanhöffen (l. c.) gives a coloured figure which is somewhat different: the head, the 3 hindmost pairs of pereiopods and the 5 last abdominal segments and the pleopods are white, the rest is red and white variegated, though the red colour is predominant, except on the 1st joint of the 3 last pereiopods, which is wholly red.

16. **Socarnes Vahlii** Kr.

Lysianassa Vahlii	Krøyer, Grønlands Amfipoder, Kgl. Danske Vid. Selsk. math. naturvid. Afh., vol 7, 1838, p. 233.
Anonyx Vahlii	Krøyer, Voyage en Scandinavie, 1846, Pl. 14, fig. 1.
— —	Krøyer, Karcinolog. Bidrag, Naturh. Tidsskr., Ny Række, vol 1, 1845, p. 599, vol 2, 1846, p. 44.
Socarnes —	Boeck, Skand. og Arkt. Amphip., 1873—76, p. 129, Pl. 6, fig. 8.
* — —	G. O. Sars, Account, vol 1, 1895, p. 44, Pl. 16, fig. 2.
— —	Stebbing, Tierreich, p. 57.

St. 95a. Sound between Renskær and Maatten, ca. 25 fm. 19—7 - 1908. Hydroid region, hard bottom. 1 spec.

17. **Orchomene serratus** Boeck.

Anonyx serratus	Boeck, Forhand. Skand. Naturforsker-Møde 1861, p. 641.
Orchomene serratus	Boeck, Skand. og Arkt. Amphip, 1873—76, p. 172, Pl. 5, fig. 2.
* — —	G. O. Sars, Account, vol 1, 1895, p. 62, p. 682, Pl. 23, fig. 1, suppl. Pl. 4, fig. 1.

St. 27. Danmarks Havn, 10—15 fm. 29—9—1906. Delesseria region, soft bottom. 1 spec.

18. **Orchomenella groenlandica** H. J. Hansen.

Anonyx groenlandicus	H. J. Hansen 1887, p. 72, Pl. 2, fig. 5.
*Orchomenella groenlandica	G. O. Sars, Account, vol 1, 1895, p. 70, Pl. 26, fig. 1.
— —	Stebbing, Tierreich, p. 83.

St. 27. Danmarks Havn, 10—15 fm. 29—9—1906. Delesseria region, soft bottom. 12 spec. New for East Greenland.

19. **Eurytenes gryllus** Mandt.

Gammarus Gryllus	Mandt, Observ. in hist. nat. in itin. Groenland, 1822, p. 34.
Eurytenes magellanicus	Lilljeborg, On the Lysianass. magell., Nova Acta Reg. Soc. Scient. Upsal., ser 3, vol 6, 1865, No. 1, p. 11, Pl. 1—3, fig. 1—22.
— gryllus	Boeck, Skand. og Arkt. Amphip, 1873—76, p. 144.
Euryporeia —	Chevreux, Résultats des Camp. sc. .... Fasc. 16,

Amphip. de l'"Hirondelle". Monaco 1900, Pl. 14, fig. 4 a—b (coloured fig.).

*Euryporeia gryllus	G. O. Sars, Account, vol 1, 1895, p. 86, Pl. 39.
Eurythenes —	Stebbing, Tierreich, p. 73.

76° N., 8° W. 31—7—1906. From the stomach of *Fulmarus glacialis*. 1 imperfect specimen, which has probably been 80 mm.

20. **Anonyx nugax** Phipps.

Cancer nugax	Phipps, Voyage towards the North-Pole 1774, p. 192, Pl. 12, fig. 2.
*Anonyx —	G. O. Sars, Account, vol 1, 1895, p. 88, Pl. 31 (partim), p. 676.
— —	Stebbing, Tierreich, p. 54.
* — —	Holmes, Proc. California Acad. Sc., ser 3, vol 3, 1904, p. 313, Pl. 35, fig. 17—19; Pl. 36, fig. 20.

St. 23. Danmarks Havn, 0—5 fm. 22—9—1906. Sand and mud with gravel and algæ. Littoral region. 1 spec.

St. 24. Danmarks Havn, 5 fm. 23—9—1906. 7 spec.

St. 25. Danmarks Havn, ca. 10 fm. 25—9—1906. Delesseria region, soft bottom. ca. 50 spec.

St. 25. Danmarks Havn, middle of entrance, 10 fm. 25—9—1906. Mud with red algæ (Delesseria region). ca. 25 spec.

St. 26. Danmarks Havn, close to Søndre Næs, 0—1 fm. 28—9—1906. Rocky and stony bottom with a little Fucus. 2 spec.

St. 27. Danmarks Havn, 10—15 fm. 29—9—1906. Delesseria region, soft bottom. 1 spec.

St. 28. Danmarks Havn, 0—10 fm. 3—10—1906. 1 spec.

St. 30. Danmarks Havn, middle of entrance. 6 fm. 7—10—1906. Sand and mud with stones and red algæ. 2 spec.

St. 31. Danmarks Havn, from the ship to land. 0—5 fm. 7—10—1906. Sand and mud with algæ. 4 spec.

St. 32. Danmarks Havn, 6 fm. 7—10—1906. Delesseria region, sand and mud with red algæ. 2 spec.

St. 34. Danmarks Havn, Opening in middle of entrance. 10 fm. 10—10—1906. Sand and mud with algæ. ca. 20 spec.

St. 37. Danmarks Havn, Opening near the ship. 5 fm. 14—10—1906. Sand and mud with algæ. 2 spec.

St. 39b. Danmarks Havn, 0—8 fm. 7—2—1907. 2 spec.

" " Danmarks Havn, 5 fm. Pelagically. 6—3—1907. 1 spec.

" " Danmarks Havn, 5 fm. On skull of a bear. 20—6—1907. 2 spec.

St. 45. Danmarks Havn, 3—6 fm. 8—7—1907. Laminaria region, soft bottom. 1 spec.
St. 57. Danmarks Havn, ca. 10 fm. 8—8—1907. Delesseria region, soft bottom. 4 spec.
St. 62. Stormbugt, off Stormkapelven. 20—30 fm. 20—8—1907. Laminaria region. 1 spec.
St. 70. Danmarks Havn, 10—15 fm. 4—9—1907. Delesseria region, soft bottom. 1 spec.
St. 71. Øresund, 15—20 fm. 4—9—1907. Hydroid region, hard bottom. 1 spec.
St. 72. Danmarks Havn, 5—8 fm. 12—9—1907. Laminaria region, soft bottom. 1 spec.
St. 72c. Stormbugt, 8—10 fm. 9—9—1907. Delesseria region, soft bottom. 1 spec.
St. 82. Danmarks Havn, 0—30 fm. 7(8)—1—1908. 3 spec.

Almost the half are large individuals of 45 mm. or more.

21. **Alibrotus littoralis** Kr.

Anonyx litoralis	Krøyer, Karcinolog. Bidrag., Naturh. Tidsskr., Ny Række, vol 1, 1845, p. 621, vol 2, 1846, p. 36.
— littoralis	Krøyer, Voyage en Scandinavie, 1846, Pl. 13, fig. 1.
Onisimus —	Boeck, Skand. og Arkt. Amphip. 1873—76, p. 162, Pl. 5, fig. 7.
*Alibrotus —	G. O. Sars, Account, vol 1, p. 102, Pl. 35, fig. 2.
Pseudalibrotus litoralis	Stebbing, Tierreich, p. 33.

St. 17. Stormkap., 0—1 fm. 18—8—1906. Margin of beach. ca. 50 spec.
St. 18f. Hvalrosodden, 0—2 fm. 25—8—1906. Littoral region, soft bottom. ca. 15 spec.
St. 18g. Hvalrosodden, Dove Bay. 0—2 fm. 26—8—1906. Sand and mud with stones. ca. 12 spec.
St. 77. Danmarks Havn, 0—20 m. 19—9—1907. 1 spec.

22. **Onisimus Edwardsii** Kr.

Anonyx Edwardsii	Krøyer, Voyage en Scandinav., 1846, Pl. 16, fig. 1.
— —	Krøyer, Karcin. Bidrag, Naturh. Tidsskr., Ny Række, vol 2, 1846, p. 1 and 41.
Onisimus —	Boeck, Skand. og Arkt. Amphip, 1873—76, p. 167, Pl. 6, fig. 4.
* — —	G. O. Sars, Account, vol 1, 1895, p. 105, Pl. 36, fig. 1.
— —	Stebbing, Tierreich, p. 25.

St. 32. Danmarks Havn, 6 fm. 7—10—1906. Delesseria region. Stones, sand and mud with red algæ. 2 spec.
St. 37. Danmarks Havn, 5 fm. 14—10—1906. Laminaria region, soft bottom. 3 spec.
St. 45. Danmarks Havn, 3—6 fm. 8—7—1907. Laminaria region, soft bottom. 1 spec.

New for East Greenland.

23. **Onisimus plautus** Kr.

Anonyx plautus Krøyer, Karcin. Bidrag, Naturh. Tidsskr., Ny Række, vol 1, 1845, p. 629, vol. 2, 1846, p. 39.
— — Krøyer, Voyage en Scand., 1846, Pl. 15, fig. 2.
Onesimus — Boeck, Skand. og Arkt. Amphip. 1873—76, p. 154, Pl. 4, fig. 2.
* — — G. O. Sars, Account, vol 1, 1895, p. 1907, Pl. 37, fig. 1.
Onisimus — Stebbing, Tierreich, p. 26.

St. 35. Danmarks Havn, 5—8 fm. 11—10—1906. Laminaria and Delesseria region, hard and soft bottom. 3 spec.

24. **Pontoporeia femorata** Kr.

Pontoporeia femorata Krøyer, Nye nordiske Sl. og Art. af Amphip., Naturh. Tidsskrift, vol 4, 1842, p. 153.
— — Krøyer, Voyage en Scand., 1846, Pl. 23, fig. 2.
— — Krøyer, Karcin. Bidrag, Naturh. Tidsskrift, Ny Række, vol 1, 1845, p. 530.
— — Boeck, Skand. og Arkt. Amphip, 1873—76, p. 197.
— furcigera Boeck, ibid. p. 200.
* — femorata G. O. Sars, Account, vol 1, 1895, p. 123, Pl. 41, fig. 1.
— — Stebbing, Tierreich, p. 128.

St. 18h. Hvalrosodden, 0—4 fm. 1—9—1906. Littoral and Laminaria region. 2 spec.
St. 21. Danmarks Havn, 5 fm. 20—9—1906. Laminaria region, soft bottom. 1 spec.
St. 45. Danmarks Havn, 3—6 fm. 8—7—1907. Laminaria region. 1 spec.
St. 57. Danmarks Havn, 5—10 fm. 9—8—1907. 1 spec.

25. **Ampelisca macrocephala** Lillj.

Ampelisca macrocephala Lilljeborg, Hafs-Crustaceer Kullaberg, Öfvers. Kgl. Svenska Vet. Akad.s Förh., vol 9, 1852, p. 6.

Ampelisca macrocephala Boeck, Skand. og Arkt. Amphip. 1873—76, p. 581, Pl. 30, fig. 8.
* — — G. O. Sars, Account, vol 1, 1895, p. 172, Pl. 60, fig. 1.
— — Stebbing, Tierreich, p. 101.

St. 62. Stormbugt, 5—10 fm. 20—8—1907. Laminaria region, soft bottom. 1 spec.

26. **Stegocephalus inflatus** Kr.

Stegocephalus inflatus Krøyer, Nye Nord. Sl. og Art. af Amphip., Naturh. Tidsskr. vol 4, 1842, p. 150.
— — Krøyer, Voyage en Scand., 1846, Pl. 20, fig. 2.
— — Krøyer, Karcin. Bidrag, Naturh. Tidsskrift, Ny Række, vol 1, 1845, p. 522, Pl. 7, fig. 3.
— ampulla Boeck, Scand. og Arkt. Amphip. 1873—76, p. 421.
* — inflatus G. O. Sars, Account, vol 1, 1895, p. 198, Pl. 69.
— — Stebbing, Tierreich, p. 91.

St. 27. Danmarks Havn, 10—15 fm. 29—9—1906. Delesseria region, soft and stony bottom. 1 spec.
St. 30. Danmarks Havn, 6 fm. 7—10—1906. Delesseria region, 1 ♀ with young.
St. 50. Danmarks Havn, 5 fm. 22—7—1907. Laminaria region, soft bottom. 1 spec.
St. 62. Stormbugt, off Stormelven. 10—20 fm. 28—8—1907. Laminaria region. 1 spec.
St. 63. Stormbugt, 10—20 fm. 20 (21)—8—1907. Delesseria region,
St. 66. Stormbugt, off Baadskær. 20 fm. 28—8—1907. Stones and shells with Delesseria. 2 spec.
St. 69. Stormbugt, 10—15 fm. 2—9—1907. Delesseria region, hard bottom. 6 spec.
St. 71. Øresund, near Koldewey Island. 15—20 fm. 4—9—1907. Hydroid region, hard bottom. ca. 15 spec.
St. 72. Stormbugt between Baadskær and Vestre Havnenæs. 10—20 fm. 9—9—1907. Stones and shells with red algæ. 4 spec.

Most individuals are 30 mm. or more and have preserved their colour.

27. **Paroediceros lynceus** M. Sars.

Oediceros lynceus, M. Sars, Overs. over Norges arkt. Krebsdyr; Forh. Vid. Selsk., Christiania 1858 (1859) p. 143.
— — Sparre Schneider, Norges Oedic., Tromsø Musæums Aarsh., No. 6, 1883, p. 14, Pl. 2, fig. 10.

Paroediceros lynceus G. O. Sars, Account, vol 1, 1895, p. 292, Pl. 103, fig. 2, Pl. 104, fig. 1.
— — Stebbing, Tierreich, p. 246.

St. 18e. Off Eskimo ruins at 2nd tenting-ground, Hvalrosnæs. 0—3 fm. 24—8—1906. Sand with stones and algæ. 2 spec.
St. 18f. Hvalrosodden, 0—2 fm. 25—8—1906. Littoral region, soft bottom. 1 spec.
St. 18g. Hvalrosodden, Dove Bay. 0—2 fm. 26—8—1906. Sand and mud with stones. 2 spec.
St. 18h. Hvalrosodden, 0—4 fm. 1—9—1906. Littoral and Laminaria region, soft bottom. 3 spec.
St. 23. Danmarks Havn, 0—5 fm. 22—9—1906. Littoral region, sand and mud with algæ and gravel. 5 spec.
St. 31. Danmarks Havn, from ship to land. 0—5 fm. 7—10—1906. Sand and mud with algæ. 4 spec.
St. 42. Danmarks Havn, 0—2 fm. 29—6—1907. Littoral region, soft bottom. 1 spec.
(No number) Danmarks Havn, off the river. 0—1 fm. 10 spec.
St. 45. Danmarks Havn, 3—6 fm. 8—7—1907. Laminaria region, 5 spec.

Most individuals are ca. 18 mm. in length.

28. **Monoculodes borealis** Boeck.

Monoculodes borealis Boeck, Crust. amphip. bor. et arct., Forh. Videnskabs-Selsk., Christiania 1870 (1871) p. 168.
— — Boeck, Skand. og Arkt. Amphip, 1873—76, p. 278, Pl. 15, fig. 4 and 6 (partim).
— — Sparre Schneider, Norges Oedic., Tromsø Musæum Aarsh., No. 6, 1883, p. 22. Pl. 1, fig. 3.
* — — G. O. Sars, Account, vol 1, 1895, p. 298, Pl. 106, fig. 2.
— — Stebbing, Tierreich, p. 262.

St. 18h. Hvalrosodden, 0—4 fm. 1—9—1906. Littoral and Laminaria region, soft bottom. 1 spec.
St. 32. Danmarks Havn, 6 fm. 7—10—1906. Delesseria region, sand and mud with stones and red algæ. 1 spec.

New for East Greenland.

29. **Monoculodes tuberculatus** Boeck.

Monoculodes tuberculatus Boeck, Crust. Amphip. bor. et arct., Forh. Vidensk. Selsk., Christiania 1870 (1871), p. 167.

Monoculodes tuberculatus Boeck, Skand. og Arkt. Amphip, 1873—76, p. 277, Pl. 15, fig. 2.
— — Sparre Schneider, Norges Oedic., Tromsø Musæums Aarsh., No. 6, 1883, p. 29, Pl. 1, fig. 8.
* — — G. O. Sars, Account, vol 1, 1895, p. 303, Pl. 107, fig. 3.
— — Stebbing, Tierreich, p. 265.

St. 57. Danmarks Havn, 5—10 fm. 8—8—1907. 3 spec.

30. Monoculodes latimanus Goës.

Oediceros latimanus Goës, Crust. amphip. maris Spetsbergiam alluentis, Öfvers. Kgl. Svenska Vet. Akad.s Förh., 1865 (1866), p. 527, Pl. 39, fig. 23.
Monoculodes — Boeck, Skand. og Arkt. Amphip., 1873—76, p. 279, Pl. 14, fig. 2.
* — — G. O. Sars, Account, vol 1, 1895, p. 304, Pl. 108, fig. 1.
— — Stebbing, Tierreich, p. 264.

St. 18h. Hvalrosodden, 0—4 fm. 1—9—1906. Littoral and Laminaria region, soft bottom. 1 spec.
St. 20b. Danmarks Havn, ca. 5 fm. 19—9—1906. Laminaria region, hard bottom. 1 spec.

31. Syrrhoë crenulata Goës.

Syrrhoë crenulata, Goës, Crust. amphip. maris Spetsbergiam alluentis, Öfvers. Kgl. Svenska Vet. Akad.s Förh., 1865 (1866), p. 527, Pl. 40, fig. 25.
— — Boeck, Skand. og Arkt. Amphip. 1873—76, p. 471, Pl. 9, fig. 5, Pl. 12, fig. 4.
* — — G. O. Sars, Account, vol 1, 1895, p. 390, Pl. 136.
— — Stebbing, Tierreich, p. 282.

St. 57. Danmarks Havn, 5—10 fm. 8—8—1907. 1 spec.

32. Pleustes panoplus Kr.

Amphithoe panopla Krøyer, Grønlands Amfip., Kgl. Danske Vid. Selsk., math. naturvid. Afh. vol 7, 1838, p. 270, Pl. 2, fig. 9.
— — Krøyer, Voyage en Scand., 1846, Pl. 11, fig. 2.
Pleustes panoplus Buchholz, Zweite deutsche Nordpolarf., 1874, vol 2, Crust., p. 334, Pl. 6.

? Pleustes panoplus, Boeck, Skand. og Arkt. Amphip., 1873—76, p. 302, Pl. 21, fig. 2.
* — — G. O. Sars, Account, vol 1, 1895, p. 344, Pl. 121.
— — Stebbing, Tierreich, p. 310.

St. 18e. Hvalrosnæs, off Eskimo ruins at 2nd tenting-ground. 0—3 fm. 24—8—1906. Sand with stones and red algæ. 1 spec.
„ „ Hvalrosnæs, Littoral and Laminaria region, soft bottom. 2 spec.
St. 21. Danmarks Havn, 5 fm. 20—9—1906. Laminaria region, soft bottom. 3 spec.
St. 27. Danmarks Havn, 10—15 fm. 29—9—1906. Delesseria region, soft and stony bottom. 2 spec.
St. 35. Danmarks Havn, 5—8 fm. 11—10—1906. Laminaria and Delesseria region, soft and hard bottom. 1 spec.
St. 45. Danmarks Havn, 3—6 fm. 8—7—1907. Laminaria region, soft bottom. 1 spec.
St. 46. Danmarks Havn, 4—6 fm. 16—7—1907. Laminaria region, soft bottom. 1 spec.
St. 56. Danmarks Havn, 4—8 fm. 28—7—1907. Boundary between Laminaria and Delesseria region. 4 spec.
St. 59b. Danmarks Havn, 5—15 fm. 14—8—1907. Boundary between Laminaria and Delesseria region. 3 spec.
St. 63. Stormbugt, 10—20 fm. 21—8—1907. Delesseria region, hard bottom. 2 spec.
St. 71. "Øresund", 15—20 fm. 4—9—1907. Hydroid region, hard bottom. 1 spec.
St. 72. Stormbugt, 8—10 fm. 9—9—1907. Delesseria region, hard bottom. 1 spec.

The largest specimen is 18 mm., the smallest 10 mm.; most are ca. 15 mm.

33. **Acanthozone cuspidata** Lepechin.

Oniscus cuspidatus Lepechin, Tres Onisc. spec. descript., Art. Acad. Sc. Imp. Petropol. 1778, P. 1, p. 247, Pl. 8, fig. 3.
Amphithoe hystrix Krøyer, Grønlands Amfip., Kgl. Danske Vid. Selsk., math. naturvid. Afh., vol 7, 1838, p. 259, Pl. 2, fig. 7.
Acanthozone — Buchholz, Zweite deutsche Nordpolarf., 1874 vol 2, Crust., p. 362, Pl. 11.
— cuspidata Boeck, Skand. og Arkt. Amphip. 1873—76, p. 229.

*Acanthozone cuspidata G. O. Sars, Account, vol 1, 1895, p. 370, Pl. 130.
? Paramphithoe hystrix Stebbing, Tierreich, p. 325.

St. 68a. "Øresund", 20—30 fm. 2—9—1907. Hydroid region, hard bottom. 1 spec.

34. **Pardalisca cuspidata** Kr. (non Buchholz).

Pardalisca cuspidata Krøyer, Nye nord. Slægt. og Arter af Amfip., Nat. Tidsskrift, vol 4, 1842, p. 153.
— — Boeck, Skand. og Arkt. Amphip. 1873—77, p. 482, Pl. 12, fig. 5.
* — — G. O. Sars, Account, vol 1, 1895, p. 403, Pl. 141, Pl. 142, fig. 1.
— — Stebbing, Tierreich, p. 223.
non Pardalisca cuspidata Buchholz, Zweite deutsche Nordpolarf., vol 2, 1874, Crust., p. 306, Pl. 1, fig. 3, Pl. 2, fig. 1.

St. 62. Stormbugt, 5—10 fm. 20—8—1907. Laminaria region, soft bottom. 1 spec.
St. 63. Stormbugt, ca. 20 fm. 20(21)—8—1907. Delesseria region, hard bottom. 1 spec.

The largest specimen is from St. 62 and measures 25 mm.

New for East Greenland.

35. **Pardalisca tenuipes** G. O. Sars.

*Pardalisca tenuipes G. O. Sars, Account, vol 1, 1895, p. 404, Pl. 142, fig. 2.
— — Stebbing, Tierreich, p. 223.

St. 63. Stormbugt, ca. 20 fm. 20(21)—8—1907. Delesseria region, hard bottom. 1 spec.

New for Greenland.

36. **Halice abysis** Boeck.

Halice abyssi + H. grandicornis, Boeck, Crust. boreal. et arct., Forhandl. Vid. Selsk. Christiania, 1870 (1871), p. 152, 153.
— abyssi Boeck, Skand. og Arkt. Amphip., 1873—76, p. 488, Pl. 10, fig. 2.
* — — G. O. Sars, Account, vol 1, 1895, p. 412, Pl. 145, fig. 2.
— — Stebbing, Tierreich, p. 229.

St. 63. Stormbugt, 10—20 fm. 28—8—1907. Delesseria region, hard bottom. 1 spec.

St. 104. 76°6′ N., 13°26′ W. 100—125 fm. 28—7—1907. Clay and gravel with shells. 12 spec.

All the specimens are relatively very large; one ♀ with eggs from St. 104 measures 16.5 mm., and most are not much smaller. Stebbing (l. c.) gives the size as 8 mm.; Sars (l. c.) 8—9 mm.

37. **Apherusa glacialis** H. J. Hansen.

*Amphitopsis glacialis H. J. Hansen, V. Grønland 1887, p. 137, Pl. 5, fig. 6.
Apherusa — Stebbing, Tierreich, p. 307.

St. 10. 75°47′ N., 12°27′ W. Surface. 7—8—1906. Among brown algæ and thin ice. ca. 30 spec.

St. 13c. 76°3′ N., 14°44′ W. ca. 300 m. 9—8—1906. From stomach of a young Phoca foetida. ca. 25 spec.

(No number) ca. 4 miles E. of Koldewey Island. Surface. 22—8—1906. Clay. 1 spec.

St. 23. Danmarks Havn, from ship into land. 0—5 fm. 22—9—1906. 2 spec.

St. 59b. Danmarks Havn, 5—15 m. 14—8—1907. Boundary between Laminaria and Delesseria region. 1 spec.

38. **Apherusa megalops** G. O. Sars.

Halirages megalops G. O. Sars, Forh. Vid. Selsk. Christiania, 1882, No. 18, p. 102, Pl. 5, fig. 4.
* — — G. O. Sars, Account, vol 1, 1895, p. 443, Pl. 156, fig. 2.
— — Stebbing, Tierreich, p. 306.

St. 57. Danmarks Havn, 5—10 fm. 8—8—1907. 1 spec.

39. **Apherusa Jurinei** M.-Edw.

Amphithoe jurinei H. M.-Edwards, Ann. Sci. nat., vol 20, 1830, p. 376.
Calliopius norvegicus Boeck, Skand. og Arkt. Amphip, 1873—76, p. 348, Pl. 22, fig. 6.
*Apherusa Jurinii G. O. Sars, Account, vol 1, 1895, p. 445, Pl. 157, fig. 1.
— jurinei Stebbing, Tierreich, p. 307.

St. 18e. Hvalrosnæs, off Eskimo ruins at 2nd tenting-ground. 0—3 fm. 24—8—1906. Sand with stones and algæ. ca. 15 spec.

40. Apherusa bispinosa Bate.

Dexamine bispinosa Bate, Ann. Nat. Hist. ser 2, vol 19, 1857, p. 142.
Halirages bispinosus Boeck, Skand. og Arkt. Amphip. 1873—76, p. 338, Pl. 23, fig. 9.
*Apherusa bispinosa G. O. Sars, Account, vol 1, 1895, p. 439, Pl. 155, fig. 1.
— — Stebbing, Tierreich, p. 305.

St. 56. Danmarks Havn, 5—8 fm. 28—7—1907. Boundary between Laminaria and Delesseria region. 1 spec.

New for Greenland.

41. Rhachotropis inflata G. O. Sars.

Tritropis inflata G. O. Sars, Forh. Vid. Selsk. Christiania, No. 18, 1882, p. 104, Pl. 5, fig. 7.
Rhachotropis inflata Stebbing, Rep. Challenger, vol 29, 1888, p. 540.
* — tumida + R. inflata G. O. Sars, Account, vol 1, 1895, p. 430, p. 697, Pl. 152.
— inflata Stebbing, Tierreich, p. 351.

St. 57. Danmarks Havn, 5—10 fm. 8—8—1907. 1 spec.

42. Halirages fulvocinctus M. Sars.

Amphithoe fulvocincta M. Sars, Oversigt over Norges Arkt. Krebsdyr, Vid. Selsk. Christiania 1858 (1859) p. 141.
Paramphithoe — Goës, Crust. amphip. maris Spetsbergiam all., Öfvers. Kgl. Svenska Vet. Akad.s Förh., 1865 (1866), p. 525, Pl. 38, fig. 15.
Halirages fulvocinctus Boeck, Skand. og Arkt. Amph., 1873—76, p. 342, Pl. 23, fig. 11.
* — — G. O. Sars, Account, vol 1, 1895, p. 436, Pl. 154.
— — Vanhöffen 1897, Pl. 1, fig. 9 (coloured fig.).
— — Stebbing, Tierreich, p. 291.

St. 15. 76°35′ N., 18°26′ W. ca. 76 fm. 18—8—1906. Stones with red algæ. 2 spec.

St. 18e. Off Eskimo ruins at 2nd tenting-ground, Hvalrosnæs. 0—3 fm. 24—8—1906, Sand with stones and algæ. ca. 15 spec.

(No number) Danmarks Havn, 0—3 fm. 24—8—1906. Littoral and Laminaria region, soft bottom. 2 spec.

St. 20b. Danmarks Havn, ca. 5 fm. 19—9—1906. Laminaria region, hard bottom. 1 spec.

St. 21. Danmarks Havn, 5 fm. 20—9—1906. Laminaria region, soft bottom. 1 spec.

St. 29. Danmarks Havn, ca. 10 fm. 7—10—1906. Delesseria region, soft bottom. 2 spec.

St. 30. Danmarks Havn, middle of entrance. 6 fm. 7—10—1906.

St. 36. Danmarks Havn, ca. 5 fm. 13—10—1906. Laminaria and Delesseria region, hard bottom. 2 spec.

St. 37. Danmarks Havn, 5 fm. 14—10—1906. Laminaria region, soft bottom. 1 spec.

St. 60. Danmarks Havn, ca. 10 fm. 14—8—1907. Delesseria region, soft bottom. 1 spec.

43. **Cleippides quadricuspis** Heller.

Cleippides quadricuspis		Heller, Denkschr. Akad. Wien, vol 35, 1875, p. 32, Pl. 3, fig. 1—16.
* —	—	G. O. Sars, Norske Nordhavs-Exp., Crust. I, 1885, p. 174, Pl. 14, fig. 5.
—	—	Stebbing, Tierreich, p. 301.

St. 64. Stormbugt, ca. 50 fm. 22—8—1907. Stones with "corals" 1 spec. (38 mm.).

44. **Pontogeneia inermis** Kr.

Amphithoë inermis		Krøyer, Grønlands Amfip., Kgl. Danske Vid. Selsk. math. naturvid. Afh., vol 7, 1838, p. 275, Pl. 3, fig. 11.
—	crenulata	Krøyer, ibid. p. 278, Pl. 3, fig. 12.
Pontogeneia inermis		Boeck, Skand. og Arkt. Amph. 1873—76, p. 335, Pl. 21, fig. 4.
* —	—	G. O. Sars, Account, vol 1, 1895, p. 451, Pl. 159.
—	—	Stebbing, Tierreich, p. 359.

St. 18e. Hvalrosnæs, off Eskimo ruins at 2nd tenting-ground. 0—3 fm. 24—8—1906. Sand with stones and algæ. 1 spec.

45. **Paratylus Smitti** Goës.

Paramphithoë Smitti Goës, Crust. Amphip. maris Spetsbergiam alluentis, Öfvers. Kgl. Svenska Vet.-Akad.s Förh., 1865 (1866), p. 524, Pl. 38, fig. 14.

Atylus Smitti	Boeck, Skand. og Arkt. Amphip. 1873—76, p. 326.
*Paratylus Smitti	G. O. Sars, Account, vol 1, 1895, p. 468, Pl. 165, fig. 1.
Nototropis —	Stebbing, Tierreich, p. 332.

St. 57. Danmarks Havn, 5—10 fm. 8—8—1907. 2 spec.
St. 69. Stormbugt, 10—15 fm. 4—9—1907. Delesseria region, hard bottom. 1 spec.

H. J. Hansen (1887, p. 129) gives this species from 6 localities, the most southerly at 69°16′ N., 58°8′ W.; the depths recorded by him lie between 50 and 183 fm. and are thus much greater than those of the Danmark Expedition.

46. **Atylus carinatus** Fabr.

Gammarus carinatus	J. C. Fabricius, Entom. Syst., vol 2, 1793, p. 515.
Amphithoë carinata	Krøyer, Grønlands Amfip., Kgl. Danske Vid. Selsk. math. naturvid. Afh., vol 7, 1838, p. 256, Pl. 2, fig. 6.
— —	Krøyer, Voyage en Scand., 1846, Pl. 11, fig. 1.
Atylus carinatus	Buchholz Zweite deutsche Nordpolarf., vol 2, 1864, Crust., p. 357, Pl. 10.
— —	Boeck, Skand. og Arkt. Amphip., 1873—76, p. 324.
* — —	G. O. Sars, Account, vol 1, 1895, p. 471, Pl. 166, fig. 1.
— —	Stebbing, Tierreich, p. 328.

St. 18e. Hvalrosnæs, off Eskimo ruins at 2nd tenting-ground. 0—3 fm. 24—8—1906. Sand with stones and algæ. 5 spec.
St. 18e. Hvalrosodden. 0—3 fm. 24—8—1906. Littoral and Laminaria region, soft bottom. 2 spec.
St. 18g. Hvalrosodden, Dove Bay. 0—2 fm. 26—8—1906. Sand and mud with stones. 3 spec.
St. 20b. Danmarks Havn, ca. 5 fm. 19—9—1906. Laminaria region, hard bottom. 1 spec.
St. 23. Danmarks Havn, 0—5 fm. 22—9—1906. Sand and mud with gravel and algæ, littoral region. ca. 12 spec.
St. 31. Danmarks Havn, from ship to land. 0—5 fm. 7—10—1906. Sand and mud with algæ. ca. 15 spec.
(No number) Danmarks Havn, off the river. 0—1 fm. 1—7—1907. 4 spec.
St. 46. Danmarks Havn, 4—6 fm. 15—7—1907. Laminaria region, soft bottom. 1 spec.
St. 48. Danmarks Havn, 3—6 fm. 18—7—1907. Laminaria region, soft bottom. 2 spec.

(No number) 17 Kilometernæsset, ca. 77° N.L. 3 fm. 6—8—1907. Littoral region, soft bottom. 2 large, many small spec.

47. Amathilla homari Fabr.

Astacus homari	J. C. Fabricius, Reise Norwegen, 1779, p. 247.
Oniscus arenarius	O. Fabricius, Fauna Groenl., 1780, No. 234, p. 259.
Gammarus Sabini	Leach, J. Ross, A Voyage of Discovery Baffin's Bay, 1819, App. No. 2, p. 63.
— —	Krøyer, Grønlands Amfip., Kgl. Danske Vid. Selsk. math. naturvid. Afh., vol 7, 1838, p. 244, Pl. 1, fig. 3.
Amathilla —	Buchholz, Zweite deutsche Nordpolarf., vol 2, 1874, Crust., p. 346, Pl. 8, fig. 1, 2, Pl. 9, fig. 1.
* — homari	G. O. Sars, Account, vol 1, 1895, p. 490, Pl. 172, 173, fig. 1.
Gammarellus —	Stebbing, Tierreich, p. 387.

St. 20 b. Danmarks Havn, ca. 5 fm. 19—0—1906. Laminaria region, hard bottom. 2 small spec.

St. 26. Danmarks Havn, close to Søndre Næs. 0—1 fm. 28—9—1906. Rocky and stony bottom with a little Fucus. 9 spec.

St. 35. Danmarks Havn, 5—8 fm. 11—10—1906. Laminaria and Delesseria region, hard bottom. 1 spec.

(No number) Along Cape Bismarck Peninsula. 20—7—1908. 1 spec.

48. Amathilla pinguis Kr.

Gammarus pinguis	Krøyer, Grønlands Amfip., Kgl. Danske Vid. Selsk. math. natur. Afh., vol 7, 1838, p. 252, Pl. 1, fig. 5.
*Amathilla —	Buchholz, Zweite deutsche Nordpolarf., vol 2, 1874, Crust., p. 353, Pl. 9, fig. 2.
— —	Boeck, Skand. og Arkt. Amphip., 1873—76, p. 411.
Weiprechtia —	Stebbing, Tierreich, p. 382.

St. 18 e. Hvalrosnæs, off Eskimo ruins at 2nd tenting-ground. 0—3 fm. 24—8—1906. Sand with stones and algæ. ca. 50 spec.

St. 18 h. Hvalrosodden, 0—4 fm. 1—9—1906. Littoral and Laminaria region, soft bottom. ca. 10 spec.

St. 20 b. Danmarks Havn, ca. 5 fm. 19—9—1906. Laminaria region, hard bottom. 1 spec.

St. 23. Danmarks Havn, 0—5 fm. 22—9—1906. Sand and mud with gravel and algæ. ca. 10 spec.

St. 56. Danmarks Havn, 5—8 fm. 28—7—1907. Boundary between Laminaria and Delesseria region. 2 spec.

49. Gammarus locusta L.

Cancer Locusta Linné, Systema Naturæ, edit. X, 1758, p. 634.
Oniscus pulex O. Fabricius, Fauna Groenlandica, 1780, p. 254, No. 231.
Gammarus locusta Boeck, Skand. og Arkt. Amphip. 1873—76, p. 366.
* — — G. O. Sars, Account, vol 1, 1895, p. 499, Pl. 1, Pl. 176, fig. 1.
— — Stebbing, Tierreich, p. 476.

St. 4b. 74°45′ N., 3°23′ W. Surface and upper layers near ice-floes at edge of drift-ice. 30—7—1906. ca. 100 large, many young spec.
St. 5. 75°19′ N., 4°42′ W. Surface and upper layers on the outer edge of drift-ice. 30—7—1906. Many young, "on oral parts and pereiopoda of the large Amphipods".
St. 9b. 76°3′N., 10°40′ W. Surface, among the ice-floes. 4—8—1906. 1 spec.
St. 13c. 76°3′ N. 14°44′ W. ca. 300 m. From the stomach of a Phoca foetida. 9—8—1906. 1 spec.
St. 17. Stormkap, 0—1 fm. 18—8—1806. Margin of the beach. 10 spec.
St. 18f. Hvalrosodden, 0—2 fm. 25—8—1906. Littoral region, soft bottom. 1 spec.
St. 18g. Hvalrosodden, Dove Bay. 0—2 fm. 26—8—06. Sand and mud with clay. 4 spec.
(No number) Danmarks Havn, from surface between an ice-floe and side of ship. 19—9—1906. 5 spec.
St. 26. Danmarks Havn, close to Søndre Næs. 0—1 fm. 28—9—1906. Rocky and sandy bottom with a little Fucus. 2 spec.
St. 42. Danmarks Havn, 0—2 fm. 29—6—07. Littoral region, soft bottom. 5 spec.
(No number) Danmarks Havn, off the river. 0—1 fm. 1—7—1907. 1 spec.
St. 45. Danmarks Havn, 3—6 fm. 8—7—1907. Laminaria region. 7 spec.
St. 59b. Danmarks Havn, 5—15 fm. 14—8—1907. Boundary between Laminaria and Delesseria region. 1 spec.
(No number) Pelagically at the surface off Maroussia, in a channel in the ice June or July 1907 or 1908. 2 spec.
„ Stormbugt, 31—8—1907. From the stomach of a Phoca foetida ♀, 135 cm. in length. Remains of 2 spec.
„ Danmarks Havn, 0—20 m. 25—9—1907. 2 spec.
St. 90. "Store Belt". 8—6—1908. On under surface of ice; thickness of ice 1.6 m. Depth of water 357 m. 2 spec.
(No number) Along Cape Bismarck Peninsula. 20—7—1908. 1 spec.

50. Gammaracanthus loricatus Sab.

Gammarus loricatus Sabine, Suppl. to the App. of Capt. Parry's Voyage, 1824, p. 231, Pl. 1, fig. 7.
* — — Krøyer, Grønlands Amfip., Kgl. Danske Vid. Selsk. math. naturvid. Afh., vol 7, 1838, p. 250, Pl. 1, fig. 4.
Gammaracanthus loricatus Boeck, Skand. og Arkt. Amphip., 1873—76, p. 400.
— — Stebbing, Tierreich, p. 508.

(No number) Danmarks Havn, Surface between an ice-floe and side of ship. 19—6—1906. 4 spec.
St. 18e. Hvalrosodden, 0—3 fm. 24—8—1906. Littoral and Laminaria region, soft bottom. 1 spec.
St. 18f. Hvalrosodden, 0—2 fm. 25—8—1906. Littoral region, soft bottom. 4 spec.
St. 18g. Hvalrosodden, Dove Bay. 0—2 fm. 26—8—1906. Sand and mud with stones. 3 spec.
St. 23. Danmarks Havn, 0—5 fm. 22—9—1906. Sand and mud with algæ and gravel. 4 spec., 2 ♀ with young.
St. 26. Danmarks Havn, close to Søndre Næs. 0—1 fm. 28—9—1906. Rocky and stony bottom with a little Fucus. 6 spec., 1 ♀ with young.
St. 45. Danmarks Havn, 3—6 fm. 8—7—1907. Laminaria region, soft bottom. 7 spec., 1 ♀ with eggs.
St. 48. Danmarks Havn, 3—6 fm. 18—7—1907. Laminaria region, soft bottom. 6 spec., 2 ♀ with eggs.
St. 49. Danmarks Havn, ca. 5 fm. 21—7—1907. Laminaria region, soft bottom. 1 spec.
(No number) 17-Kilometernæsset, ca. 77° N.B. 3 fm. 6—8—1907. Littoral region, soft bottom. 10 spec., 1 large ♀ with eggs.
Locality not stated. 4 spec.

1 ♀ from St. 48 is 62 mm., most are not much less (Stebbing (l. c.) gives 43—58 mm.). — New for East Greenland.

51. Æginella spinosissima Stimps.

Ægina longicornis Krøyer, Naturhist. Tidsskrift, vol 4, 1843. p. 509, Pl. 7, fig. 1—12.
— — P. Mayer, Caprellida. Flora u. Fauna Golf. Neapel, 6te Monogr., 1882, p. 33.
— — P. Mayer, Nachtrag, ibid. 17te Monogr., 1890, p. 32.
— — P. Mayer, Caprell., "Siboga"-Exp., 1903, p. 60.

Æginella spinosissima Stimpson, Marine Invertebrata Grand Manan, Smiths. Contrib. to Knowl., 1854, vol 6, p. 44.
— — P. Mayer l. c., 1890, p. 37.
— — P. Mayer l. c., 1903, p. 61.
*Ægina spinifera G. O. Sars, Norske Nordhavs-Exp., Crust. I, 1885, p. 228, Pl. 18, fig. a—c, x.

St. 63. Stormbugt, ca. 20 fm. 20(21)—8—1907. Delesseria region, hard bottom. ca. 100 spec.
St. 68 a. "Øresund", 20—30 fm. 2—9—1907. Hydroid region, hard bottom. ca. 20 spec.
St. 71. "Øresund", 15—20 fm. 4—9—1907. Hydroid region, hard bottom. 5 spec.
St. 71. "Øresund", 15—20 fm. 4—9—1907. Hydroid and Delesseria region, hard bottom. ca. 10 spec.
St. 71. Along N. E. coast of N. Koldewey Island. 15—20 fm. 4—9—1907. Stony bottom with shells, hydroids and red algæ. 1 spec.
St. 95 a. Sound between Renskær and Maatten. ca. 25 fm. 19—7—1908. Hydroid region, hard bottom. 1 spec.
Locality not stated. 1 very large spec. (45 mm.).

52. **Arcturus Baffini** Sab.

Idothea Baffini Sabine, Suppl. to the App. to Cap. Parry's Voyage, 1824, p. 228, Pl. 1, fig. 4—6.
Arcturus — Milne-Edwards, Hist. Nat. d. Crust., vol 3, 1840, p. 123, Pl. 31, fig. 1.
* — — G. O. Sars, Norske Nordhavs-Exp., Crust. I, 1885, p. 97, Pl. 9, fig. 1—21.
* — — H. Richardson, Monograph. Isop. N.-Am. 1905, p. 337, with figs.

St. 63. Stormbugt, 10—20 fm. 21—8—1907. Delesseria region, hard bottom. ca. 12 spec.
St. 66. Stormbugt, off Baadskær. 20 fm. 28—8—1907. Stones and shells with Delesseria. 2 spec.
St. 68 a. Øresund, 20—30 fm. 2—9—1907. Hydroid region, hard bottom. many spec.
St. 71. Øresund, 15—20 fm. 15—20 fm. 4—9—1907. Hydroid and Delesseria region, hard bottom. 2 spec.
St. 72. Stormbugt, 8—10 fm. 9—9—1907. Delesseria region, hard bottom. 1 spec.
St. 95. Sound between Renskær and Maatten. 25—50 fm. 19—7—1908 Hydroid region, hard bottom. 1 spec.

St. 96. Off Maroussia. 80—90 fm. 22—7—1908. Hydroid region, hard bottom. 5 spec.

St. 99. 77° N., 18 1/2° W. 300 m. 22—7—1908. 1 young spec. on Antedon prolixa.

Locality not stated. 3 spec.

The largest (a ♀ from St. 68a) is 54 mm. (trunk) + 68 mm. (2nd pair of antennæ).

53. **Phryxus abdominalis** Kr.

Bopyrus abdominalis	Krøyer, Naturhist. Tidsskr. vol 3, 1840, p. 102 and p. 289, Pl. 1—2.
— —	Krøyer, Voyage en Scand., Crust., 1846, Pl. 29, fig. 1.
Phryxus hippolytes	Rathke, Beitrag zu Fauna Norwegens, Nova Acta Academ. Leopoldino Carolinæ Naturæ Curiosorum, vol 20, 1844, p. 40, Pl. 2, fig. 1—10.
* — abdominalis	G. O. Sars, Account, vol 2, 1899, p. 215, Pl. 90, 91.
— —	Richardson, Monograph Isop. N.-Am., 1905, p. 500, with figs.

St. 21 Danmarks Havn, 3—5 fm. 20—9—1906. Laminaria region, soft bottom. 1 spec.

St. 60. Danmarks Havn, ca. 10 fm. 14—8—1907. Delesseria region, soft bottom. 1 spec.

St. 65. Danmarks Havn, 5—10 fm. 25—8—1907. Delesseria and Laminaria region. 1 spec.

(No number) Stormbugt, 31—8—1907. From the stomach of a Phoca foetida ♀ of 135 cm. 1 spec.

St. 68 a. Øresund. 20—30 fm. 2—9—1907. Hydroid region, hard bottom. 1 spec.

St. 69. Stormbugt, off Vestre Havnenæs. 10—15 fm. 4—9—1907. Delesseria region. 9 spec.

St. 70. Danmarks Havn, 10—15 fm. 4—9—1907. Delesseria region, soft bottom. 2 spec.

St. 72 a. Stormbugt, 10—20 fm. 9—9—1907. Delesseria and Hydroid region, hard bottom. 3 spec.

(No number) Danmarks Havn, 5—10 fm. End of July 1908. Delesseria region, soft bottom. 12 spec.

All the specimens were found on *Spirontocaris polaris,* except at the last-mentioned station, where 9 were on *Sp. turgida* and 1 on *Sp. Gaimardii.*

54. Bopyroides hippolytes Kr.

Bopyrus Hippolytes Krøyer, Grønlands Amfip., Kgl. Danske Vid. Selsk. math. naturvid. Afh., vol 7, 1838, p. 306, Pl. 4, fig. 22.
— — Krøyer, Voyage en Scand., Crust. 1846, Pl. 28, fig. 2.
Bopyroides acutimarginatus Stimpson, Proc. Acad. Nat. Sci. Philadelph., 1864, p. 156.
* — hippolytes G. O. Sars, Account, vol 2, 1899, p. 199, Pl. 84, fig. 2.
— — Richardson, Monograph Isop. N.-Am. 1905, p. 567, with figs.

St. 18e. Hvalrosodden, 0—3 fm. 24—8—1905. Littoral and Laminaria region, soft bottom. 2 spec.
St. 27. Danmarks Havn, 10—15 fm. 29—9—1906. Delesseria region, soft bottom. 1 spec.
St. 35. Danmarks Havn, 5—8 fm. 11—10—1906. Delesseria and Laminaria region, hard bottom. 1 spec.
St. 48. Danmarks Havn. ca. 5 fm. 18—7—1907. Laminaria region. 1 spec.
St. 49. Danmarks Havn, ca. 5 fm. 21—7—1907. Laminaria region, soft bottom. 1 spec.
St. 57a. Danmarks Havn, 8—10 fm. 8—8—1907. Delesseria region, soft bottom. 1 spec.
St. 72. Stormbugt, 10—20 fm. 9—9—1907. Delesseria and Hydroid region, hard bottom. 1 spec.
St. 72a. Stormbugt, 10—20 fm. 9—9—1907. Delesseria and Hydroid region, hard bottom. 2 spec.
(No number) Danmarks Havn, 5—10 fm. End of July 1908. Delesseria region, soft bottom. 5 spec.
St. 96. Off Maroussia. 80—90 fm. 22—7—1908. Hydroid region, hard bottom. 1 spec.

All the specimens were found on *Spirontocaris polaris*. Two of the hosts each had two parasites, 1 specimen on each side of the carapace (St. 18e and St. 72a); in some the parasite was not present, but as the carapace had the characteristic bulging on the one side, there can be no doubt, that this was due to a Bopyrus, which must have fallen out (St. 35, 48, 49, 57a, 72 and Danmarks Havn, end of July 1908, 2 spec.). Similar formations may be due certainly to Copepods of the family Choniostomatidae (*Choniostoma mirabile* H. J. Hansen: Krebsdyr fra Kara-Havet, Dijmpha-Togtets zool.-bot. Udbytte, København 1887, p. 271, Pl. 24, fig. 7 and H. J. Hansen: The Choniostomatidae, a fam. of copepoda, parasites on Malacostraca, Copenhagen 1897), but as not a single specimen of Choniostoma was found, though

several of *Bopyroides*, the formations must be due to the latter. One of the prawns (from St. 49) was remarkable in having eggs, though the parasites otherwise usually give their hosts the appearance of the opposite sex, whilst castrating them (Giard: Castration parasitaire, Bull. scient. France et Belgique, 1888). The fact that this individual nevertheless bears eggs, thus indicates, that the sexual organs may again come into function if the parasite falls off (the prawn in question was one of those, in which the parasite had merely left its mark in the bulging of the carapace).

55. **Dajus Mysidis** Kr.

Dajus Mysidis	Krøyer, Voyage en Scand., Crust., 1846, Pl. 28, fig. 1.
Leptophryxus Mysidis	Buchholz, Zweite deutsche Nordpolarf., vol 2, Crust., 1874, p. 288, Pl. 2, fig. 2.
*Dajus Mysidis	G. O. Sars, Account, vol 2, 1899, p. 223, Pl. 93—94.
— —	Richardson, Monograph Isop. N.-Am., 1905, p. 573, with figs.

St. 20a. Danmarks Havn, 5—10 fm. 19—9—1906. Delesseria region, soft and hard bottom. 1 spec.

St. 23. Danmarks Havn, 0—5 fm. 22—9—1906. Littoral region, sand and mud with algæ and gravel. 2 spec.

St. 48. Danmarks Havn, 4—6 fm. 18—7—1907. Laminaria region, soft bottom. 1 spec.

St. 56. Danmarks Havn, 5—8 fm. 28—7—1907. Boundary between Laminaria and Delesseria region. 3 spec.

St. 57. Danmarks Havn, 8—10 fm. 8—8—1907. 3 spec.

St. 59b. Danmarks Havn, 3—8 fm. 14—8—1907. Boundary between Laminaria and Delesseria region. 10 spec.

St. 59b. Danmarks Havn, 5—8 fm. 14—8—1907. Laminaria and Delesseria region, soft bottom. 1 spec.

(No number) Danmarks Havn, 25—9—1907. 2 spec.

„ Danmarks Havn, 5—10 fm. End of July 1908. Delesseria region, soft bottom. 2 spec.

All are attached to *Mysis oculata*. In spite of very careful search, I have not succeeded in determining how the animal is attached.

56. **Cryptocope arctica** H. J. Hansen.

*Cryptocope arctica	H. J. Hansen, Krebsdyr fra Kara-Havet, Dijmphna-Togtets zool.-botan. Udbytte, 1887, p. 209, Pl. 21, fig. 4.

Cryptocope arctica H. J. Hansen, V. Grønl. 1887, p. 180, Pl. 7, fig. 1.
* — — Richardson, Monograph Isop. N.-Am., 1905, p. 16, with figs.

St. 66. Stormbugt, between Baadskær and Store Koldewey Island. 15—20 fm. 28—8—1907. 1 spec.
New for East Greenland.

57. **Diastylis scorpioides** Lepech.

Oniscus scorpioides Lepechin, Acta Acad. Sci. Imp. Petropol, 1778, p. 248, Pl. 8, fig. 3.
Cuma Edwardsii Krøyer, Fire nye Arter Cuma, Naturh. Tidsskrift 1. R., vol 3, 1841, p. 504, p. 531, Pl. 5, fig. 1—16.
— — Krøyer, Voyage en Scand., Crust., 1846, Pl. 4, fig. a—v.
— brevirostris Krøyer, ibid, Pl. 5A, fig. 1.
— Edwardsii Krøyer, Karcinolog. Bidrag, Naturhist. Tidsskrift, Ny R., vol 2, 1846, p. 128, p. 207, Pl. 1, fig. 1*, 3, 5, 9—14.
— brevirostris Krøyer, ibid., p. 174, p. 208, Pl. 2, fig. 6.
*Diastylis scorpioides G. O. Sars, Account, vol 3, 1900, p. 58, Pl. 44.
— — Zimmer, "Fauna arctica", vol 1, 1900, p. 424.

St. 21. Danmarks Havn, ca. 5 fm. 20—9—1906. Laminaria region, soft bottom. 1 spec.
St. 45. Danmarks Havn, 3—6 fm. 8—7—1907. Laminaria region, soft bottom. 7 spec.
St. 57. Danmarks Havn, 5—10 fm. 8—8—1907. Delesseria region, mud. 1 spec.
St. 62. Danmarks Havn, 5—10 fm. 20—8—1907. Laminaria with stones. 2 spec.
St. 72. Danmarks Havn, 5—8 fm. 12—9—1907. Laminaria region. 2 spec.

58. **Nebalia bipes** O. Fabr.

Cancer bipes O. Fabricius, Fauna Groenlandica, 1780, p. 246, No. 223, fig. 2.
Nebalia — Krøyer, Grønlands Amfip., Kgl. Danske Vid. Selsk. math. naturvid. Afh., vol 7, 1838, p. 319.
— — Krøyer, Voyage en Scand., Crust. 1846, Pl. 40, fig. 2.
— — Karcinolog. Bidrag, Naturhist. Tidsskrift, 2. R., vol 2, 1847, p. 436.
* — — G. O. Sars, "Fauna Norvegica", vol 1, Phyllocarida and

Phyllopoda, Christiania 1896, p. 9, Pl. 1, fig. 1—3, Pl. 2—3, Pl. 4, fig. 1—8, Pl. 5.

Nebalia longicornis Thomson, On a new Sp. of Nebalia from New Zealand, Ann. Mag. Nat. Hist. ser 5, vol 4, 1879, p. 418, Pl. 19, fig. 7—9 (teste Ohlin 1901, p. 13).

St. 61. Danmarks Havn, 5—8 fm. 15—8—1907. Delesseria region, soft and hard bottom. 1 spec.

59. **Balanus porcatus** Costa.

Balanus porcatus Costa, Hist. Nat. Test. Brit., 1778, p. 249.

* — — Darwin, Monogr. of Cirriped., Balanidæ, 1854, p. 256, Pl. 6, fig. 4.

— — Weltner, Verzeichnis d. bisher beschrieb. recenten Cirripedienarten, Archiv f. Naturgesch., Jahrg. 63, vol 1, 1897, p. 267.

— — Weltner, "Fauna arctica" vol 1, 1900, p. 293, Pl. 8, fig. 1—13.

St. 63. Stormbugt, 10—20 fm. 21—8—1907. Delesseria region, hard bottom. ca. 50 spec.

St. 66. Stormbugt, off Baadskær. 20 fm. 28—8—1907. Stones and shells with Delesseria. 8 spec., half were dead.

St. 69. Stormbugt, off Vestre Havnenæs. 10—15 fm. 2—9—1907. Stones and shells, Delesseria. ca. 15 spec., half were dead.

St. 71 a. Øresund, 15—20 fm. 4—9—1907. Hydroid and Delesseria region, hard bottom. 1 spec.

St. 72. Stormbugt between Baadskær and Vestre Havnenæs. 10—20 fm. Stones and shells with Delesseria. Some poor fragments.

? 60. **Balanus crenatus** Brug.

Balanus crenatus Bruguière, Encycl. Method. Hist. Nat. d. Vers, vol 6, 1789, p. 168.

* — — Darwin, Monogr. of Cirriped., Balanidæ, 1854, p. 261. pl. 6, fig. 6.

— — Weltner, Verzeichnis d. bisher beschrieb. recenten Cirripedienarten, Archiv f. Naturgesch., Jahrg. 63, vol 1, 1897, p. 268.

— — Weltner, "Fauna arctica", vol 1, 1900, p. 303.

St. 71. Øresund. 15—20 fm. 4—9 1907. Hydroid and Delesseria region, hard bottom. 1 spec.

The specimen is 8 mm. high and probably belongs to this species, but the form of the tergum closely resembles *B. porcatus.*

61. **Sylon (hippolytes** Kr. ?)

Sylon hippolytes Krøyer, Bemærkninger om en meget ufuldstændigt bekjendt Gruppe af Krebsdyr Pachybdella . . . ., Oversigt Kgl. Danske Vid. Selsk.s Forh. 1855, p. 127, (in German: Creplin, Zeitschr. gesammt. Naturwiss., vol 8, 1856, p. 419).
— — M. Sars, Bidrag .... Kristianiafjordens Fauna, Nyt Mag. f. Naturvid., vol 17, 1870, p. 154, Pl. 10, fig. 54–59.
— — Weltner, "Fauna arctica", vol 1, 1900, p. 299.
* — — G. Smith, Rhizocephala. Flora u. Fauna Golf. Neapel, 29. Monogr., 1906, p. 116.
— Daniellseni Giard, Bull. Sci. France Belgique, ser 3, vol 1, 1888, p. 443 (teste Smith l. c.).
— — + S. hippolytes, Weltner, Verzeichnis d. bisher beschrieb. recent. Cirripedienarten, Archiv für Naturgesch., Jahrg. 63, vol 1, 1897, p. 236.

St. 65. Danmarks Havn, 5—10 fm. 25—8—1907. Laminaria and Delesseria region, soft bottom. 1 spec. on *Spirontocaris polaris.*

Several authors give Sylon from Greenland simply as "Sylon sp." According to Giard the Sylon occurring on *Spirontocaris polaris* belongs to the species *Sylon Daniellseni*, but G. Smith (l. c. p. 116) is of opinion that individuals on this host also belong to the typical species *S. hippolytes* Kr. Vanhöffen (1897, p. 210) notes from W. Greenland a *Spirontocaris polaris* with 2 specimens of Sylon.

62. **Herpyllobius arcticus** Stp. & Ltk.

Lernæa sp. Krøyer, Grønlands Amfip., Kgl. Danske Vid. Selsk. math. naturvid. Afh., vol 7, 1838, p. 93. No. 58.
*Herpyllobius arcticus Steenstrup og Lütken, Snyltekrebs og Lernæer, Kgl. Danske Vid. Selsk. Skrifter, 5. Række, math.-naturvid. Afd., vol 5, 1861, p. 426, Pl. 15, fig. 20.
*Silenium Polynoës Krøyer, Snyltekrebsene, Naturhist. Tidsskrift, 3. Række, vol 2, 1863, p. 403, Pl. 18, fig. 6.
— crassirostris M. Sars, Bidrag til Kristianiafjordens Fauna, Nyt Mag. f. Naturvid., Christiania 1870, p. 114, Pl. 8, fig. 10—15.
Herpyllobius arcticus Levinsen, Nogle parasit. Krebsdyr, Vid. Medd.

Naturh. Foren. Kjøbenhavn 1877, p. 363, Pl. 6, fig. 12—18.

Herpyllobius arcticus H. J. Hansen, Dijmphna-Togtets zool.-botan. Udbytte, 1887, p. 262, Pl. 24, fig. 2.

— — Søren Jensen, Nogle Oplysninger om .... Herpyllobius arcticus Stp. & Stk. og Fam. Herpyllobiidæ H. J. H., Oversigt Kgl. Danske Vid. Selsk. Forh., 1900, p. 84, Pl. 1, fig. 8—9, Pl. 2, fig. 10—18.

St. 18h. Hvalrosodden. 0—5 fm. 1—9—1906. Littoral and Laminaria region, soft bottom. 2 spec.

St. 72. Danmarks Havn, 5—8 fm. 12—9—1907. Laminaria region, soft bottom, 1 spec.

All 3 specimens are found on *Harmothoë imbricata* var. *impar*. The 2 from St. 18h. are both attached close together almost midway on the back of the worm; one is very shrunken, which seems to be due to the alcohol; otherwise there is no difference from the type, except that both are attached to the back instead of on the front end of the worm. The specimen from St. 72 has eggs, the 2 from St. 18h none.

63. **Anchorella uncinata** O. Fr. Müller.

Lernæa uncinata O. Fr. Müller, "Zoologia Danica", 1779, Pl. 33, fig. 2.

— — O. Fabricius, Fauna Groenlandica, 1780, No. 328.

*Anchorella — Krøyer, Naturhist. Tidsskrift, vol 1, 1836. p. 193, p. 290, Pl. 3, fig. 8.

Ships Harbour. 20—6—1907. From the gills of a *Gadus saida* 310 mm. long. ca. 10 spec.

64. **Lernæopoda carpionis** Kr.

Lernæa salmonea O. Fabricius, Fauna Groenlandica, 1780, No. 327.

Lernæopoda carpionis Krøyer, Danmarks Fiske, vol 2, 1845, p. 58 note.

* — — Krøyer, Snyltekrebsene, Naturh. Tidsskrift, 3. R., vol 2, 1863, p. 277, Pl. 14, fig. 4.

The large lake behind Hvalrosodden. 6—7—1908. From a large *Salmo salvelinus* ♂. ca. 20 spec.

65. **Philomedes globosus** Lilljb.

Cypridina globosa Lilljeborg, De Crust. ex ordin. trib. in Scan. occurr., 1853, p. 271, Pl. 17, fig. 2—10, Pl. 18, fig. 1—3, 7.

Philomedes longicornis	Lilljeborg, ibid., p. 176, pl. 24, fig. 4—6, fig. 14—16.
* — brenda	Brady & Norman, Monograph of the marine & freshwater Ostracoda of the North Atlantic and of North Western Europe. Sc. Transact. Royal Dublin Soc., ser 2, vol 5, 1896, p. 654, Pl. 51, fig. 1—3, Pl. 56, fig. 1—3.
— —	Vanhöffen 1897, p. 381, Pl. 1, fig. 3 (coloured fig.).

St. 23. Danmarks Havn, from the ship to land. 0—5 fm. 22—9—1906. Sand and mud with algæ. 1 spec.
St. 43. Danmarks Havn, 3—5 fm. 1—7—1907. Littoral and Laminaria region. 1 spec.
St. 45. Danmarks Havn, 3—6 fm. 8—7—1907. Laminaria region, soft bottom. 1 spec.
St. 62. Danmarks Havn, 5—10 fm. 20—8—1907. 3 spec.
St. 72. Danmarks Havn, 5—8 fm. 12—9—1907. Laminaria region, soft bottom. 1 spec.

66. **Nymphon mixtum** Kr.

Nymphon mixtum	Krøyer, Pycnog., Naturhist. Tidsskrift, Ny Række, vol 1, 1845, p. 110.
* — —	G. O. Sars, Norske Nordhavs-Exp., Pycnog., 1891, p. 68, Pl. 6, fig. 3.
— grossipes	Møbius, "Fauna arctica", vol 2, 1902, p. 41.
— —	Meinert, "Ingolf" 1899, p. 35.

St. 63. Stormbugt, 10—20 fm. 21—8—1907. Delesseria region, soft bottom. 2 spec. (one with eggs).
St. 95. Danmarks Havn, 25—50 fm. 19—7—1908. 1 spec. with eggs.
St. 96. Off Maroussia. 80—90 fm. 22—7—1908. Hydroid region, hard bottom. 1 spec.

67. **Nymphon Stroemi** Kr.

Nymphon Strømi	Krøyer, Pycnog., Naturhist. Tidsskrift, Ny Række, vol 1, 1845, p. 111.
— —	Krøyer, Voyage en Scand., 1846, Pl. 35, fig. 3.
* — —	G. O. Sars, Norske Nordhavs-Exp., Pycnog., 1891, p. 80, Pl. 8, fig. 2.
— —	Møbius, "Fauna arctica", vol 2, 1902, p. 46.
— —	Meinert, "Ingolf" 1899, p, 40.

St. 96. Off Maroussia. 80—90 fm. 22—7—1908. Hydroid region, hard bottom. 3 spec.

St. 104 b. 76°06′ N., 13°26′ W. 200—250 m. 28—7—1908. Clay and gravel. 1 spec.

68. **Nymphon serratum** G. O. Sars.

Nymphon serratum G. O. Sars, Archiv f. Math. og Naturvid., vol 4, 1879, p. 471.
* — — G. O. Sars, Norske Nordhavs-Exp., Pycnog., 1891, p. 95, Pl. 10, fig. 2.
— — Møbius, "Fauna arctica", vol 2, 1902, p. 45.
— — Meinert, "Ingolf" 1899, p. 37.

St. 68 a. Øresund, 20—30 fm. 2—9—1907. Hydroid region, hard bottom. 1 spec.

St. 96. Off Maroussia. 80—90 fm. 22—7—1908. Hydroid region, hard bottom. 2 spec.

69. **Chætonymphon hirtipes** Bell.

Nymphon hirtipes Bell, in Belcher, Last of the arctic Voyages, vol 2, 1855, p. 408, Pl. 35, fig. 3.
— spinosum Goodsir, Edinburgh new Philos. Journ., vol 32, 1842, p. 139, Pl. 3, fig. 3.
— — Goodsir, Ann. Mag. Nat. Hist., vol 14, 1844, p. 3, Pl. 1, fig. 17—18.
*Chætonymphon hirtipes G. O. Sars, Norske Nordhavs-Exp., Pycnog., 1891, p. 103, Pl. 11, fig. 2.
— ? spinosum Møbius, "Fauna arctica", vol 2, 1902, p. 48.
Nymphon — Meinert, "Ingolf", 1899, p. 44.

St. 96. Off Maroussia, 80—90 fm. 22—7—1908. Hydroid region, hard bottom. 1 spec.

70. **Eurycyde hispida** Kr.

Zetes hispidus Krøyer, Pycnog., Naturh. Tidsskrift, Ny Række, vol 1, 1845, p. 114.
— — Krøyer, Voyage en Scand., 1846, Pl. 38, fig. 1.
*Eurycyde hispida G. O. Sars, Norske Nordhavs-Exp., Pycnog., 1891, p. 128, Pl. 14, fig. 1.
— — Møbius, "Fauna artica", vol 2, 1902, p. 54.

St. 63. Stormbugt, 10—20 fm. 21—8—1907. Delesseria region, hard bottom. 2 spec.

Zoogeographical remarks on the Malacostraca and Pycnogonida of the Greenland fauna.

Since H. J. Hansen wrote his great work on the "Malacostraca marina Groenlandiæ occidentalis eller Oversigt over det vestlige Grønlands Fauna af malakostrake Havkrebsdyr" in "Vid. Meddel. Naturh. Foren.", Kjøbenhavn 1887, pp. 1—226, in which the older literature on the Crustacea of Greenland is summarized, only a single work has appeared with a complete list of Greenland's Crustacea, namely that of Vanhöffen: Crustaceen in Drygalski "Grönland-Exp. d. Gesellsch. f. Erdkunde zu Berlin 1891—93", vol 2, Berlin 1897, p. 193 and p. 279.

Of large new works which give lists of northern animals, including the Crustacea of Greenland, there are only 3, namely, "The Danish "Ingolf" Expedition", "Nordisches Plankton" and "Fauna arctica". Of the "Ingolf" publications referring to the present groups we have only Meinert's Pycnogonida 1899 and H. J. Hansen's Malacostraca I 1908 (Decapoda, Euphausidacea, Mysidacea); in "Nordisches Plankton" and in "Fauna arctica" most of the Crustacean groups have been dealt with. With regard to smaller papers with reports on expeditions and the like, reference may be made to the list of literature.

In his "Report on the Echinoderms . . . . Danmark Expedition" (Medd. om Grønland, vol 45, 1910, pp. 287—289) Dr. Th. Mortensen gives a brief review of the hydrographical conditions at Greenland, and reference may be made to that paper for these conditions. Without expressly emphasizing it, Mortensen places the boundary for the Greenland fauna midway in the great oceanic depths west and east of Greenland, and as this boundary is a practical one, it is used for convenience here.

Vanhöffen (1897, l. c.) mentions in all 278 species of Greenland Malacostraca and Pycnogonida, namely 24 Decapoda, 4 Euphausidacea, 13 Mysidacea, 16 Cumacea, 165 Amphipoda, 28 Isopoda, 8 Tanaidacea, 20 Pycnogonida. Only 15 years after Vanhöffen's list we now have 357 species, as will be seen from the following list. * means, that the species mentioned is not in Vanhöffen's list; the name in ( ) refers to the author who first noted the species as belonging to Greenland.

Decapoda. 1. Chionoecetes opilio O. Fabr.
2. Hyas araneus L.
3. — coarctatus Leach.
*4. Neolithodes Grimaldii M.-Edw. & Bonnier (H. J. Hansen "Ingolf" 1908).
*5. Lithodes Maja L. (ibid).
*6. Paralomis spectabilis H. J. H. (ibid).

Decapoda. *7. Paralomis Bouvieri H. J. H. (ibid).
8. Eupagurus pubescens Kr.
*9. Munida tenuimana G. O. Sars, (H. J. Hansen "Ingolf" 1908).
*10. Galacantha rostrata M.-Edw. (ibid).
*11. Munidopsis curvirostris Whiteaves (ibid).
*12. — Antonii M. Edw. (ibid).
*13. — similis Smith (ibid).
*14. Polycheles nanus Smith (ibid).
15. Selerocrangon ferox G. O. Sars.
16. — boreas Phipps.
17. Nectocrangon lar Owen.
*18. Sabinea hystrix M.-Edw. (H. J. Hansen "Ingolf" 1908).
19. — Sarsii Smith.
20. — septemcarinata Sab.
*21. Pontophilus norvegicus M. Sars (H. J. Hansen "Ingolf" 1908).
*22. Glyphocrangon sculptus Smith (ibid).
23. Spirontocaris Fabricii Kr.
24. — Gaimardii M.-Edw.
25. — spinus Sow.
*26. — Lilljeborgii Danielssen (not in Vanhöffen's list, as he perhaps considers it a variety of *Sp. spinus* Sow.).
27. Spirontocaris macilenta Kr.
28. — turgida Kr.
29. — polaris Sab.
30. — groenlandica J. C. Fabr.
31. — microceros Kr.
*32. Bythocaris gracilis Smith (H. J. Hansen "Ingolf" 1908).
*33. Bythocaris simplicirostris G. O. Sars (Buchholz 1874, not given by Vanhöffen).
*34. Bythocaris leucopis G. O. Sars (Ohlin 1901).
*35. — Payeri Heller (Ohlin 1901).
*36. Pandalus borealis Kr.
37. — Montagui Leach.
*38. — propinquus G. O. Sars (H. J. Hansen "Ingolf" 1908).
*39. Acanthephyra purpurea M.-Edw. (ibid).
40. Pasiphae tarda Kr.
*41. Parapasiphae sulcatifrons Smith (H. J. Hansen "Ingolf").
42. Hymenodora glacialis Buchh.

Decapoda. 43. Gennadas elegans Smith.
44. Sergestes arcticus Kr.

Euphausidacea *45. Thysanopoda acutifrons Holt & Tatt. (H. J. Hansen "Ingolf").
*46. Meganyctiphanes norvegica M. Sars (Buchholz 1874, not given by Vanhöffen).
47. Thysanoessa longicaudata Kr.
(Thysanoessa neglecta should be discorded as independent species and placed with Rhoda inermis and called Thysanoessa inermis, see H. J. Hansen, The genera and species of the order Euphausiacea, with account of remarkable variation. Bull Inst. Océanogr. Monaco, No. 210, 1911, p. 8—13 and p. 38.)
48. Thysanoessa inermis Kr., see above.
49. Rhoda Raschii M. Sars.
50. Nematoscelis megalops G. O. Sars (H. J. Hansen "Ingolf" 1908).

Mysidacea 51. Gnathophausia zoea Will.-Suhm (H. J. Hansen ibid).
*52. Eucopia unguiculata Will.-Suhm (ibid).
*53. — sculpticauda Faxon (ibid).
*54. Hansenomysis fyllæ H. J. H. (ibid).
*55. Boreomysis tridens G. O. Sars (ibid).
56. — nobilis G. O. Sars.
57. — arctica Kr.
*58. — microps G. O. Sars (K. Stephensen "Tjalfe").
*59. Longithorax fuscus H. J. H. (ibid).
60. Erythrops abyssorum G. O. Sars.
61. — erythrophthalma Goës.
*62. — glacialis G. O. Sars (Ohlin 1901).
*63. Meterythrops robusta Smith (ibid).
*64. — picta Holt & Tatt. (H. J. Hansen "Ingolf" 1908).
65. Parerythrops speciabilis G. O. Sars.
66. Amblyops abbreviata M. Sars.
*67. — Crozetii Ohlin (Ohlin 1901).
68. Pseudomma roseum G. O. Sars.
*69. — frigidum H. J. H. (Ohlin 1901? H. J. Hansen "Ingolf").
70. Pseudomma truncatum Smith.
71. — parvum Vanhöffen.

Mysidacea. *72. Pseudomma Theeli Ohlin (Ohlin 1901).
73. Stilomysis grandis G. O. Sars.
74. Mysis oculata O. Fabr.
75. — mixta Lilljb.

Cumacea. 76. Lamprops fuscata G. O. Sars.
77. Leucon longirostris G. O. Sars.
78. — nasicus Kr.
79. — nasicoides Lilljeb.
80. — serratus Norman.
81. Eudorella emarginata Kr.
82. Eudorellopsis integra Smith.
83. — deformis Kr.
84. Diastylis armata Norman.
85. — Rathkei Kr.
86. — spinulosa Heller.
87. — scorpioides Lepech.
88. — Goodsiri Bell.
89. Diastylopsis resima Kr.
90. Campylaspis rubicunda Lilljeb.
91. — carinata H. J. H.

Amphipoda. 92. Lanceola Clausi Bovall.
93. — Loveni Bovall.
94. — serrata Bovall.
? 95. — Sayana Bovall. (Vosseler, Plankton-Exp.; K. Stephensen "Tjalfe").
96. Vibilia Kroeyeri Bovall.
97. Mimonectes Steenstrupi Bovall.
98. Hyperia medusarum O. Fr. Müll.
99. — galba Mont.
100. Hyperoche medusarum Kr.
101. Parathemisto oblivia Kr.
102. Euthemisto libellula Mandt.
103. — compressa Goës.
*104. — bispinosa Boeck (not in Vanhöffen; probably taken with preceding species).
*105. Scina sp. (K. Stephensen "Tjalfe").
? Hyale Nilssoni Rathke (not known with certainty from Greenland; see H. J. Hansen, V.-Grønl. 1887, p. 61).
106. Ambasia Danielsseni Boeck.
*107. Cyclocaris guilelmi Chevreux (Broch and Koefod in Duc d'Orleans 1907).
108. Socarnes bidenticulatus Bate.

Amphipoda. 109. Socarnes Vahlii Bate.
110. Hippomedon Holboelli Kr.
111. — denticulatus Bate.
112. — abyssi Goës.
*113. Cyphocaris anonyx Boeck (K. Stephensen "Tjalfe").
*114. Metacyphocaris Helgæ Tattersall (ibid).
115. Eurytenes gryllus Mandt.
116. Aristias tumidus Kr.
*117. Anonyx affinis (Ohlin 1895).
118. — nugax Phipps.
119. — gulosus Kr. (= Hoplonyx cicada Fabr. Vanhöffen 1897, Amphip., p. 212, No. 24, which should thus be discorded).
120. Alibrotus littoralis Kr.
121. Onisimus Edwardsii Kr.
122. — plautus Kr.
*123. Katius obesus Chevreux (K. Stephensen "Tjalfe").
124. Orchomenella groenlandica H. J. H.
125. — minuta Kr.
*126. Orchomene serratus Boeck (Grieg, in Duc d'Orléans 1909).
127. Tryphosa nanoides Lilljb.
128. — pulchra H. J. H.
129. Opisa Eschrichtii Kr.
130. Pontoporeia femorata Kr.
131. Prinassus Nordenskioeldii H. J. H.
132. Priscilla armata Boeck.
133. Argissa typica Boeck.
134. Phoxocephalus Holboelli Kr.
135. Paraphoxus oculatus G. O. Sars.
136. Harpinia plumosa Kr.
137. — mucronata G. O. Sars.
138. Stegocephalus inflatus Kr.
139. — ampulla Phipps.
140. Andaniella pectinata G. O. Sars.
141. Gitanopsis (Amphilochus) bispinosus Boeck.
142. — — inermis G. O. Sars.
143. Amphilochus manudens Bate (= A. concinnus Stebbing).
144. Amphilochus oculatus H. J. H.
145. Metopa clypeata Kr.
146. — borealis G. O. Sars.
147. — pollexiana Bate.

Amphipoda. 148. Metopa latimana H. J. H.
149. — glacialis Kr.
150. — groenlandica H. J. H.
151. — longimana Boeck.
152. — neglecta H. J. H.
153. — longicornis Boeck.
154. — Bruzelii Goës.
155. — carinata H. J. H.
? 156. — nasuta Boeck.
157. Danaia (Cressa) abyssicola G. O. Sars.
158. Syrrhoe crenulata Goës.
159. Tiron acanthurus Lilljb.
160. Acanthostepheia Malmgreni Goës.
161. Oediceros saginatus Kr.
162. — borealis Boeck.
163. Paroediceros lynceus M. Sars.
164. — curvirostris H. J. H.
165. Monoculodes crassirostris H. J. H.
166. — Kroeyeri Boeck.
167. — latimanus Boeck.
168. — tuberculatus Boeck.
169. — borealis Boeck.
170. — simplex H. J. H.
171. Monoculopsis longicornis Boeck.
172. Halimedon Mülleri Boeck.
173. — brevicalcar Goës.
174. — megalops G. O. Sars.
175. Bathymedon obtusifrons H. J. H.
176. Aceros phyllonyx M. Sars.
177. Aceroides latipes G. O. Sars (= Aceros distinguendus H. J. H., teste Stebbing, Tierreich, p. 255).
178. Pleustes panoplus Kr.
179. Paramphithoë pulchella Kr.
180. — Boekii H. J. H.
181. — bicuspis Kr.
182. — assimilis G. O. Sars.
*183. Parapleustes glacilis Buchh. (Buchholz 1874, not in Vanhöffen).
184. Parapleustes glaber Boeck.
185 — latipes M. Sars.
186. — pulchellus G. O. Sars.
187. — Olrikii H. J. H.
188. Epimeria loricata G. O. Sars.

Amphipoda. 189. Acanthonotosoma serratum O. Fabr.
190. — inflatum Kr.
191. Odius carinatus Bate.
192. Acanthozone cuspidata Lepech.
193. Paratylus Smitti Goess.
194. Atylus carinatus J. C. Fabr.
195. Pontogeneia inermis Kr.
196. Apherusa megalops G. O. Sars.
197. — Jurinii M.-Edw.
*198. — bispinosa Bate (Danmark-Exp.).
199. — glacialis H. J. H.
200. Amphitopsis (Halirages) megalops Buchh.
*201. — longicaudata Boeck (K. Stephensen "Tjalfe").
202. Halirages fulvocinctus M. Sars.
203. — quadridentatus G. O. Sars.
204. Calliopius læviusculus Kr.
*205. — Rathkei Zaddach (Sars: 2. "Fram"-Exp. 1909).
206. Leptamphopus longimanus Boeck.
207. Cleippides tricuspis Kr.
208. — quadricuspis Heller.
209. Leucothoe spinicarpa Abildg.
210. Rhachotropis aculeata Lepech.
211. — inflata G.O.Sars (= R.tumida G. O. Sars).
212. — oculata H. J. H.
213. — fragilis Goës.
214. — Helleri Boeck.
*215. Cleonardo microdactylus K. St. (K. Stephensen "Tjalfe"; n. sp.).
*216. Eusirus Tjalfiensis K. St. (ibid.; n. sp.).
217. — Holmi H. J. H.
218. — cuspidatus Kr.
219. Lilljeborgia fissicornis M. Sars.
*220. Pardalisca abyssi Boeck (= P. cuspidata Buchh., *non* Kr.) (not in Vanhöffen).
221. Pardalisca cuspidata Kr., *non* Buchh.
*222. — tenuipes G. O. Sars (Danmark-Exp.).
*223. Halice abyssi Boeck. (Grieg, in Duc d'Orleans 1909.)
224. Nicippe tumida Bruz.
225. Gammarus locusta L.
226. Moera Loveni Bruz.
227. Melita dentata Kr.
228. — Goësii H. J. H. (= M. formosa Murdoch).

Amphipoda. 229. Melita amoena H. J. H.
230. Gammaracanthus loricatus Sab.
231. Amathilla homari Fabr.
232. — pinguis Kr.
233. Amathillopsis spinigera Heller (Grieg in Duc d'Orléans 1909).
234. Ampelisca Eschrichtii Kr.
235. — macrocephala Lillj.
236. Haploops tubicola Lillj.
237. — setosa Boeck.
238. Byblis Gaimardii Kr.
239. Photis Reinhardi Kr.
240. — tenuicornis G. O. Sars.
241. Goësia depressa Goës.
242. Protomedeia fasciata Kr.
243. Gammaropsis melanops G. O. Sars.
244. Podoceropsis Lindahli H. J. H.
245. Pleonexes gammaroides Bate (= Sunamphithoë longicornis Boeck).
246. Podocerus (Ischyrocerus) anguipes Kr.
247. Ischyrocerus megacheir Boeck.
248. — latipes Kr.
249. — brevicornis G. O. Sars.
250. — (Podocerus) nanoides H. J. H.
251. Erichthonius megalops G. O. Sars.
252. Siphonoecetes typicus Kr.
253. Unciola leucopis Kr. (*non* U. irrorata Say).
254. — laticornis H. J. H.
255. — crassipes H. J. H.
256. — planipes Norman.
257. Neohela monstrosa Boeck.
258. Dulichia spinosissima Kr.
259. — porrecta Bate.
260. — curticauda Boeck (= D. tuberculata Boeck).
261. — macera G. O. Sars.
*262. Paradulichia typica Boeck (Ortmann 1901).
*263. Ingolfiella abyssi H. J. Hansen (Journ. Linn. Soc., Zool., vol 29, 1903).
264. Cercops Holboelli Kr.
265. Æginella spinosissima Stimpson (= Ægina longicornis Kr. = Ægina spinifera G. O. Sars).
266. Caprella septentrionalis Kr. (= C. monocera G. O. Sars, teste P. Mayer, Siboga Caprell. p. 121).

Amphipoda. 267. Caprella dubia H. J. H. (*non* C. microtuberculata G. O. Sars var. spinigera H. J. H., teste G. O. Sars, Account, vol 1, 1895, p. 665, and P. Mayer, Siboga Caprell. p. 100).
268. Caprella microtuberculata G. O. Sars.
269. — horrida G. O. Sars (= C. spinosissima Norman).
270. Cyamus mysticeti Ltk.
271. — monodontis Ltk.
272. — nodosus Ltk.
273. Paracyamus boopis Ltk.

Isopoda. 274. Anthelura abyssorum Norm. & Stebb.
275. Calathura brachiata Stimpson.
276. Anceus elongatus Kr.
277. — cristatus H. J. H.
278. — robustus G. O. Sars.
279. Æga crenulata Ltk.
280. — psora L.
281. — arctica Ltk.
282. — ventrosa M. Sars (= Æ. Nordenskioeldii Bovall).
? 283. Rocinela maculata Sch. & Mein. (doubtful for Greenland, se H. J. Hansen, V. Grønl. 1887, p. 187).
284. Glyptonotus Sabini Kr.
285. Idothea metallica Bosc.
286. Edotia nodulosa Kr.
287. Arcturus Baffini Sab.
288. — hystrix G. O. Sars.
289. Astacilla granulata G. O. Sars.
*290. Acanthoniscus typhlops G. O. Sars (K. Stephensen "Tjalfe").
291. Janira maculosa Leach.
292. — tricornis Kr.
293. — spinosa Harger (= ? Janthe Jolella) speciosa Bovall.).
*294. Janthe (Tole) libbeyi Ortmann (Ortmann 1901).
*295. — laciniata G. O. Sars (K. Stephensen "Tjalfe").
296. Jæra albifrons Leach (= J. marina O. Fabr.).
297. Munna Fabricii Kr.
298. — Kroeyeri Goodsir.
299. Munnopsis typica M. Sars.
*300. Munneurycope Tjalfiensis K. St. (K. Stephensen "Tjalfe", n. sp.).
301. Eurycope robusta Harger (= E. cornuta G. O. Sars).

Isopoda. *302. Eurycope gigantea G. O. Sars (Grieg in Duc d'Orleans 1909).
303. Ilyarachna hirticeps G. O. Sars.
*304. — Bergendahli Ohlin (Ohlin 1901).
305. Phryxus abdominalis Kr.
306. Bopyroides hippolytes Kr.
307. Dajus Mysidis Kr.
*308. Holophryxus Richardii Koehler (K. Stephensen "Tjalfe").
*309. Holophryxus Acanthephyræ K. St. (ibid. , n. sp).
*310. Clypeoniscus Meinerti Giard et Bonnier (Bull Sci. France et Belgique, ser 4, vol 25, 1893).

Tanaidacea. 311. Apseudes gracilis Norm. & Stebb.
312. Alaotanais (Neotanais) hastiger Norm. & Stebb.
313. Heterotanais limicola Harger.
314. Pseudotanais forcipatus Lillj.
315. — Lilljeborgi G. O. Sars.
316. Leptognathia longiremis Lilljb., *non* G. O. Sars.
317. Cryptocope arctica H. J. H.
318. Sphyrapus anomalus G. O. Sars.
*319. — serratus G. O. Sars (Ohlin 1901).
*320. — malleolus Norm. & Stebb. (Transact. Zool. Soc. London, vol 12, 1886).

Pycnogonida. 321. Pycnogonum littorale Strøm.
322. Phoxichilidium femoratum Rathke.
*323. Cordylochele (Pallene) malleolata G. O. Sars (Meinert "Ingolf").
*324. Cordylochele brevicollis G. O. Sars (Lönnberg 1903).
*325. — longicollis G. O. Sars (Meinert "Ingolf").
*326. Pallene acus Meinert (ibid).
*327. — hastata Meinert (ibid).
328. — (Pseudopallene) circularis Goodsir.
329. — — spinipes Fabr.
330. Nymphon brevitarse Kr.
331. — grossipes Fabr.
332. — mixtum Kr.
333. — longitarse Kr.
334. — microrhynchum G. O. Sars.
335. — gracilipes Heller.
336. — Stroemi Kr.
337. — elegans H. J. H.
*338. — longimanum G. O. Sars (Lönnberg 1903).
339. — serratum G. O. Sars.

Pycnogonida.

*340. Nymphon leptocheles G. O. Sars (Meinert "Ingolf").
341. — megalops G. O. Sars.
*342. — macrum Wilson (Meinert "Ingolf").
343. — Hoekii Meinert (ibid).
*344. — Groenlandicum Meinert (ibid).
*345. — Sluiteri Hoek (Lönnberg 1903).
*346. Paranymphon spinosum Caullery (Meinert "Ingolf").
? *347. Chætonymphon hirtum Fabricius (Buchholz 1874) (probably confounded with No. 349, teste G. O. Sars, Norw. North Atlant. Exp., Pycnog. p. 103).
*348. Chætonymphon tenellum G.O.Sars (Meinert "Ingolf").
*349. Chætonymphon hirtipes Bell (= C. spinosum Stimps).
350. — macronyx G. O. Sars.
351. Boreonymphon robustum Bell.
*352. Ascorhynchus abyssi G. O. Sars (Lönnberg 1903).
353. Eurycyde hispida Kr.
354. Colossendeis proboscidea Sab.
*355. — colossea Wilson (Meinert "Ingolf").
*356. — angusta G. O. Sars (Lönnberg 1903).
*357. — macerrima Wilson (Meinert "Ingolf").

Our knowledge regarding the distribution of the Crustacea at East Greenland is very imperfect, only a few, very restricted areas having been investigated; for West Greenland we have much better information. Nevertheless, even there it is only the coastal animals whose distribution can be indicated in any way completely. The only work existing on the Greenland Crustacea with all the localities known at the time is that by H. J. Hansen mentioned above on the Malacostraca of West Greenland from 1887. By merely turning over the leaves of this work we can at once see, whether a species belongs to the coastal belt, or if it is a deep-water form (— at that time practically nothing was known about the true plankton forms —); the list of the localities for the coastal forms fills namely perhaps a couple of pages, whilst the deep-water species must be contented with some few lines. Though 25 years have passed since then, the conditions have not essentially altered, although there are naturally many new localities on the whole (and new species). Further, as each new expedition brings home new species belonging especially to the deep-water forms and the plankton or increases our knowledge greatly with regard to the distribution of the already known species, we can see that, in spite of our apparently very good knowledge of the Crustacean fauna of Greenland, much is still wanting before we can state the distribution of the

single species with certainty. We must also remember, that Greenland extends over more than 20 degrees of latitude, so that even if the list of localities for a species filled 2—3 pages, it would still be very incomplete.

In the Zoological Museum of Copenhagen there is a large material, still not worked up, of Crustacea from Greenland, especially from the "Ingolf" Expedition (as mentioned, the only works published are those on the Decapoda, Euphausidacea, Mysidacea and Pycnogonida); from the Swedish Expedition of 1898—99 to Spitzbergen and East Greenland, under the direction of Prof. Nathorst, nothing has as yet been published regarding the Amphipoda.

In the following pages an endeavour will be made to subdivide the Greenland Malacostraca into natural groups according to their geographical distribution, and it is my hope, that this work, though in the nature of the case imperfect, will yet be able to give an outline in the main lines correct of the zoogeography of the Greenland Malacostraca.

We can distinguish between the following faunas: 1. an arctic and 2. an Atlantic deep-water fauna ($>$ 200 m.); 3. a littoral fauna ($<$ 200 m.) and 4. plankton (for the sake of convenience all the Mysidacea and Euphausidacea are taken with the plankton, though a few species, e. g. *Mysis oculata,* are really coastal forms).

Where in the following no definite source is stated, this is as a rule: for Decapoda, Euphausidacea and Mysidacea — H. J. Hansen, "Ingolf" 1908, and "Fauna arctica"; for Cumacea — Sars, "Account", and "Fauna arctica"; for Amphipoda — Sars, "Account" and Stebbing, Tierreich; for Isopoda and Tanaidacea — Sars, "Account", and H. Richardson, "Monograph" 1905, and for Pycnogonida — "Fauna arctica" and Norman, Podosomata 1908. H. J. Hansen, V. Grønland 1887, has been used for all the Malacostraca.

1. The arctic deep-water fauna.

This is distributed partly in the deep water north of the ridge in Davis Straits (ca. 66° N., from Holstenborg in West Greenland to Cape Walsingham in Baffin Land), partly in the cold area of the Polar Sea. A number of the species from the cold area go eastwards right into the Kara Sea and several are found at East Greenland in quite shallow water.

The large marine basin north of the ridge in Davis Straits is one of the least known waters of Greenland. With regard to the Echinoderm fauna Dr. Th. Mortensen writes (Report Echinoderms ... Danmark Expedition, Meddel. om Grønland, vol 45, 1910, pp. 292—93) "... most probably, however, the fauna of the deep basin will prove

to have been derived from the Atlantic fauna occurring in the Davis Strait". Among the Crustacea Mortensen's hypothesis seems to apply only to the plankton forms, not to the bottom-animals. As the following lists will show, namely, this region has 6 endemic species, 37 (perhaps only 25) species common with the cold area of the Polar Ocean but only 2 species (*Pandalus borealis* and *Pseudomma parvum*) common with the deep Atlantic. If we place the boundary between the boreal and arctic regions at 0°, as seems reasonable, the geographical boundary between these two regions at West Greenland cannot be drawn at the ridge, but somewhat more to the north, namely, north of Umanak Fjord (ca. 71° N.), as we can still notice the influence of the Atlantic water there, the bottom-water having a positive temperature (J. N. Nielsen in Ad. S. Jensen: Indberetning om Fiskeriundersøgelserne ved Grønland i 1908. Beretninger og Kundgør. vedrør. Kolonierne i Grønland, No. 2, 1909, pp. 24—27). For practical reasons, however, we may continue to place the faunistic boundary at the ridge mentioned. The case of *Pandalus borealis* and *Pseudomma parvum*, which at West Greenland are found to the north as far as Umanak Fjord, seems to be the only one, which at the present moment would require the zoogeographical boundary to be moved further north.

The Arctic deep-water fauna may be divided into 3 groups according to the distribution of the species; A. species endemic to West Greenland, B. species from the cold area of the Polar Ocean and C. species common to both regions.

1A. Species endemic to the cold deep basin at West Greenland.

There are only 6 of these, namely:

Hippomedon abyssi.	Unciola laticornis.
Eusirus Tjalfiensis.	— crassipes.
Ischyrocerus (Podocerus) nanoides.	Anceus cristatus.

Hippomedon abyssi is widely distributed in the Davis Strait N. of 68°36′ N. (20—25) 100—280 fm. (H. J. Hansen 1887 and "Tjalfe").

Eusirus Tjalfiensis has been taken at 70°41′ N., 52°07′ W,, 386 fm., 800 m. wire out ("Tjalfe").

Ischyrocerus nanoides is only known from 71°10′ N., 58°56′ W· 200 fm. (H. J. Hansen 1887).

Unciola laticornis: 69°16′ N., 58°8′ W., 339 m. (H. J. Hansen 1887).

Unciola crassipes: 66°22′ N., 57°16′ W., 686 m. ("Tjalfe") and 71° 10′ N., 58°56′ W. 200 fm. (H. J. Hansen 1887).

Anceus cristatus: 72°32′ N,, 58°51′ W. 116 fm. (H. J. Hansen 1887).

1 B. Species from the cold area of the Polar Ocean.

Some of the species go eastwards into the Kara Sea and one is found at East Greenland in quite shallow water. Two species, *Stegocephalus ampulla* and *Colossendeis proboscidea* are also found north of Siberia. The species are the following:

Sclerocrangon ferox.	Anceus robustus.
? Bythocaris simplicirostris.	Arcturus hystrix.
— leucopis.	Ilyarachna Bergendahlii.
— Payeri.	Eurycope gigantea.
Stegocephalus ampulla.	Sphyrapus anomalus.
Halirages quadridentatus.	— serratus.
Cleippides quadricuspis.	Ascorhynchus abyssi.
Halice abyssi.	Nymphon megalops.
Amathillopsis spinigera.	Eurycyde hispida.
? Ischyrocerus megacheir.	? Colossendeis proboscidea.
— brevicornis.	— angusta.
Dulichia macera.	

The plankton forms *Erythrops glacialis, Pseudomma frigidum* and *Cyclocaris Guilelmi* as well as *Amblyops Crozetti* and *Pseudomma Theeli* have the same distribution as this group; the last two are only known from East Greenland.

Sclerocrangon ferox occurs from E. Greenland to the Kara Sea and in the south to N. E. of Shetland.

Bythocaris simplicirostris seems to have its main distribution in the cold area, but goes both farther east (Murman Coast) and S. (Mandal S. of Stavanger); it occurs generally in positive temperatures and has only a few times been taken in lower temperatures, namely, E. Greenland (Kaiser Franz Josef Fjord 73°30′ N., 133 fm. (Ohlin 1901), Pendulum Isl. $74^{1}/_{3}$° N., 110 fm. (H. J. Hansen "Ingolf" 1908) and N. Shannon ca. 75° N. 30 fm. (Buchholz)) and a little S. E. of the Faeroes 61°23′ N., 5°04′ W. 255 fm., 0° (H. J. Hansen "Ingolf"); see further Appellöf 1906, p. 167 and H. J. Hansen "Ingolf" 1908, p. 69. It is thus doubtful, how far this species can with right be said to belong to the cold area.

Bythocaris leucopis and *B. Payeri* belong to about the whole cold area (H. J. Hansen, "Ingolf").

Stegocephalus ampulla has a very wide distribution right from Greenland (H. J. Hansen 1887, locality not stated) to Siberia (Stuxberg "Vega"). Sars (Norwegian North-Atlantic Exped.) gives it from 11 localities, all belonging to the cold area or the sea eastwards; that the records really apply to the species *S. ampulla* Phipps and not *S. inflatus* Kr. seems beyond all doubt, as Sars would otherwise

have mentioned any confusion in his "Account", as he has done in other cases (e. g. *Eusirus Holmi* and *E. cuspidatus*). Stebbing (Tierreich) does not cite Sars' record from the Norwegian North Atlantic Exped., so that one cannot see from this, whether any confusion has taken place.

Halirages quadridentatus has been taken at E. Greenland, 70°32′N., 8°10′ W. 470 fm. (H. J. Hansen 1895; it is there called *H. quadrispinosus,* it is true, but this must be a misprint for *H. quadridentatus*); 63°5′ N., 3°0′ E., 960 m., —1.1° C. and 66°41′ N., 6°59′ E. 640 m., —0.9 C. (Sars Norwegian North-Atlantic Exped. St. 33 and 124) and 60° N., 5° 51′ W. 988 m., 29.2° F. (Norman, Proc. Roy. Soc. Edinb., vol 11, 1882, p. 688).

Cleippides quadricuspis is distributed from 67°—80° N. 16° E.—12°W., 603—1890 m.; the Danmark Expedition however has taken it at but 50 fm.

Halice abyssi has been found at E. Greenland, between 75°58′N., 14°08′ W., and 75°59′ N., 14°12′ W., 300 m. (Duc d'Orléans 1909), and Stormbugt (ca. 77° N.) 10—20 fm. and 76°06′ N., 13°26′ W., 100—125 fm. (Danmark Exped.); 62°44′ N., 1°48′ E., 753 m., —1° C. and 71°59′ N., 11°40′ E., 2030 m., —1.3° C. (Sars Norwegian North-Atlantic Exped.). According to Sars "Account", it is found along the whole Norwegian coast in 100—400 fm. and thus seems to follow the Norwegian Channel.

Amathillopsis spinigera has been taken at W. Greenland 77°31′ N., 18°24′ W., 275 m. (Grieg in Duc d'Orléans 1909); besides it is known from Spitzbergen, Franz Josef Land and W. Norway: 63°06′ N., 2°46′ W., 915 m., —1.7° C. (Grieg l. c.).

Ischyrocerus megacheir is found at E. Greenland, 69°25′ N., 20°01′ W., 167 fm. (H. J. Hansen 1895). The Norwegian North-Atlantic Exped. gives the species from 8 localities: E. of Iceland 64°36′ N., 10°22′ W., 547 m., —0.3° C.; S. and W. of Spitzbergen 76°19′ N., 18°1′ E., 267 m., —1.1° C., 76°34′ N., 12°51′ E., 1359 m., —1.2° C. and 78°02′ N., 9°25′ E., 761 m., + 0.8° C.; S. W. of Bear Island 73°47′ N., 14°21′ E., 1403 m., —1.4° C.; round Lofoten 66°41′ N., 6°59′ E., 640 m., —0.9° C., 71°25′ N., 15°41′ E., 1134 m., —1.0° C. and (Vestfjord) 68°12′ N., 15°40′ E., 624 m., + 6.5 C. Further, it has been taken at Busse Sound, Vardø (Stebbing: Willem Barentz) and at Newfoundland, 1267 m. (Chevreux, Hirondelle 1900). — The occurrence at the high temperature in Vestfjord is remarkable, and Newfoundland is quite outside the region.

Ischyrocerus brevicornis is known from E. Greenland: 69°25′ N., 20°01′ W., 167 fm. and 72°26′ N., 19°35′ W., 135 fm. (H. J. Hansen 1895). The Norwegian North-Atlantic Exp. has taken it at 5 places, namely, N. W. and S. of Spitzbergen 80°03′ N., 8°28′ E., 475 m., + 1.1° C.,

79°59′ N., 5°40′ E., 839 m.,—1.0° C. and 76°19′ N., 18°01′ E., 267 m., —1.1° C.; S. W. of Bear Island 73°47′ N., 14°21′ E., 1403 m., — 1.4° C., off Cape Stadt 63°10′ N., 5°0′ E. 763 m., —1.0° C. Towards the east it has been taken at 74° N., 45° E., 301 m (Hoek).

Dulichia macera has been taken at E. Greenland: 70°32′ N., 8°10′ W., 470 fm. (H. J. Hansen 1895). The Norwegian North-Atlantic Exped. has found it N. of Vesteraalen Islands 69°41′ N., 15°51′ E., 1591 m., —1.2° C. and between Finmarken and Bear Island 72°57′ N., 14°32′ E., 817 m., —0.8° C.

Anceus robustus has been taken at E. Greenland: 69°25′ N., 20°1′ W., 167 fm. and 70°32′ N., 8°10′ W., 470 fm. (H. J. Hansen 1895); further by the Norwegian North-Atlantic Exped. between Norway and Bear Island 69°41′ N., 15°51′ E., 870 fm., —1.2° C. and W. of Spitzbergen 78°02′ N., 9°25′ E. 416 fm., 0.8° C.

Arcturus hystrix is known from E. Greenland 72°26′—72°53′ N., 96—105 fm. (H. J. Hansen 1895) and 74°52′ N., 17°16′ W., 350 m. (Ohlin 1901). Norman (1904 "Porcupine" Exped., p. 446) gives it from the Faeroe Channel 59°54′ N., 7°52′ W., 355 fm. and 60°21′ N., 5°41′ W., 580 fm. The Norwegian North-Atlantic Exped. took it N. of the Shetlands 62°44′ N., 1°48′ E. 412 fm., —1.0° C. and S. W. and W. of Lofoten 66°41′ N., 6°59′ E., 350 fm., —0.9° C., and 68°21′ N., 10° 40′ E., 457 fm., —0.7° C.

Ilyarachna Bergendahli is only known from E. Greenland 71°33′ N., 21°30′ W., 1 km. from Murray Island, 200 m., and Spitzbergen 78° 50′ N., 27°39′ E., King Charles Island, 20 m., b.-t. + 0.2° C. (Ohlin 1901). This species is thus possibly a coastal form.

Eurycope gigantea is known from E. Greenland: 66°42′ N., 26°40′ W., 550 m., + 0.11°, from 9 stations in the cold area (Sars: Norw. North Atl. Exp. and Grieg: Duc d'Orléans 1909); besides it has been taken at 68 stations in the Kara Sea (Stuxberg: "Vega" 1887 and H. J. Hansen: "Dijmphna" 1887).

Sphyrapus serratus has been taken at E. Greenland 74°52′ N., 17° 16′ W. 350 m. (Ohlin 1901) and is given by the Norwegian North-Atlantic Exped. from 63°22′ N., 5°29′ W., 2222 m., —1.2° C., 65°53′ N., 7°18′ W., 2127 m., —1.1° C. and 77°58′ N., 5°10′ E., 2438 m., —1.4° C.

Sphyrapus anomalus is known from E. Greenland 69°25′ N., 20° 01′ W., 167 fm. and 72°40′ N., 20°10 W., 100 fm. (H. J. Hansen 1895). The Norwegian North-Atlantic Exped. has taken it between Jan Mayen and Iceland 69°02′ N., 11°26′ W. 1836 m., —1.1° C. In the "Account" Sars states, that it is found along the whole Norwegian coast and in the Skager Rak, and the Danish research-steamer "Thor" has taken it at 2 places in the Skager Rak at 280 and 350 fm.

(H. J. Hansen 1909); it thus seems to belong to the cold area plus the Norwegian Channel.

Ascorhynchus abyssi is distributed in about the whole cold area (Lönnberg 1903).

Nymphon megalops seems to occur everywhere in the cold area, as it is known from E. Greenland to N. W. of Finmarken and from S. W. of Spitzbergen to the Færoe-Shetland Channel. The localities are the following: E. Greenland: 64°24′ N., 35°14′ W., 767 fm., 1.46° C. (at Angmagsalik) and 65°39′ N., 28°26′ W., 553 fm. (Meinert "Ingolf"); besides from 4 miles E. to Seidisfjord (Iceland), 135 fm. ("Ingolf") and E. of Iceland 64°39′ N., 11°22′ W., 547 m., —0.3 C. (Sars: "Norwegian North-Atlantic Exped."). At the Færoes: 61°23′ N., 5°04′ W., 225 fm., 0° C., 62°58′ N., 7°09′ W., 388 fm., —0.4° C., 63°26′ N., 7°56′ W., 471 fm., —0.6° C. ("Ingolf"). Off Storeggen: 63°10′ N., 5°0′ E., 763 m., —1.0° C., N. W. of Finmarken 71°25′ N., 15°41′ E., 1134 m., 1.0° C. and S. W. of Spitzbergen 76°34′ N., 12°51′ E., 1359 m., —1.2° C. (Sars: "Norwegian North Atlantic Exped.").

Eurycyde hispida has a similar distribution, but goes farther east, being taken at the Murman Coast (Jarzynsky) and in the Kara Sea (H. J. Hansen "Dijmphna" 1887, and "Vega" Exped.).

Colossendeis proboscidea has been included in this group not without doubt. It certainly has its main distribution in the cold area (Möbius in "Fauna arctica" and Norman 1908), but it goes to the east as far as north of Siberia (Stuxberg "Vega") and is found in arctic North America (Sabine). It is not found in deep water off W. Greenland, but on the other hand at the coast S. of the ridge in Davis Strait: 65°27′ N., 54°45′ W., 67 fm. (Meinert "Ingolf"). The species thus seems to be circumpolar.

Colossendeis angusta is widely distributed in the cold area and at the N. coast of N. America N. to 38° N. ("Fauna arctica" and Lönnberg 1903).

1C. Species common to the cold area of the Polar Ocean and the northern deep basin at West Greenland.

Harpinia mucronata.	? Paratylus Smitti.
? Stegocephalus inflatus.	? Amphitopsis longicaudata.
Cressa (Danaia) abyssicola.	? Leptamphopus longimanus.
? Acanthostepheia Malmgrenii.	Eusirus Holmi.
? Bathymedon obtusifrons.	? Goësia depressa.
Aceros phyllonyx.	Erichthonius megalops.
Parapleustes latipes.	Neohela monstrosa.
? Epimeria loricata.	Æginella spinosa.
Acanthozone cuspidata.	Caprella horrida.

Caprella microtuberculata.	? Eurycope robusta.
? Calathura brachiata.	Pseudotanais Lilljeborgii.
Anceus elongatus.	Cryptocope arctica.
Arcturus Baffini.	? Nymphon serratum.
Astacilla granulata.	— elegans.
? Janira maculosa.	Boreonymphon robustum.
Ilyarachna hirticeps.	

The plankton forms *Boreomysis nobilis, Meterythrops robusta, Parerythrops spectabilis, Pseudomma truncatum,* (?) *Munnopsis typica* and (?) *Eurycope robusta* have the same distribution as this group; they will be discussed under group 4.

Harpinia mucronata has been found at West Greenland: 71°10′ N., 58°56′ W., 200 fm. (H. J. Hansen 1887) and S. W. and S. E. of Bear Island: 71°25′ N., 15°41′ E., 1134 m., —1.0°C. and 70°30′ N., 32°35′ E., 271 m., + 1.9° C. (Sars, Norwegian North Atlantic Exped.).

Stegocephalus inflatus seems to belong to this group but goes eastwards as far as Siberia and is thus possibly circumpolar. At East Greenland (ca. 77° N.) it has been taken by the Danmark Expedition in quite shallow water, 5—20 fm., whilst the "Tjalfe" has taken it north of the ridge in Davis Strait down to 253 fm. Two localities are of interest: Shetland (Norman) and Arsuk Fjord in W. Greenland (ca. 61° N.) (H. J. Hansen 1887). Sars ("Account") states that it occurs along the whole Norwegian coast from Christiania Fjord to Vadsø, 100—150 fm., especially in the "coral" belt.

Acanthostepheia Malmgrenii, which will be mentioned under group 3D, perhaps belongs here.

Cressa (Danaia) abyssicola has been taken at West Greenland: 71°10′ N., 58°56′ W., 200 fm. (H. J. Hansen 1887) and between Finmarken and Bear Island: 72°57′ N., 14°32′ E., 817 m., —0.8° C. (Norwegian North-Atlantic Exped.).

Bathymedon obtusifrons has been found at West Greenland: 68°9′ N., 56°32′ W., 48 fm. and 68°24′ N., 54°39′ W., 215 fm. (H. J. Hansen 1887); further at Franz Josefs Land (Scott 1899) and Finmarken 100 fm. (Sars: Account). It can thus be met with in much shallower water than 100 fm. and is perhaps in reality a coastal form (group 3 C).

Parapleustes latipes seems to be rare at West Greenland; it has only been taken 4 times from 66°22′ N. to 70°30′ N., 100 fm. — 686 m. (H. J. Hansen 1887 and "Tjalfe"). Otherwise it is only known from 70°32′ N., 8°10′ W., 470 fm. (H. J. Hansen 1895), the whole of Norway 30—100 fm. (Sars "Account") and the British Isles. Though it may not seem right according to the localities mentioned, it seems most

reasonable to refer the species to this group; there is but little probability that it should be included in group 3 E.

Aceros phyllonyx and *Acanthozone cuspidata* seem to be circumpolar, being distributed from West Greenland (or Arctic America) eastwards to and including Siberia. *Aceros phyllonyx* is found at Bohuslän and is said to have been taken in the North Sea 60 miles N. of Peterhead (Metzger, teste Sars: "Account"). *Acanthozone* has been taken in the Norwegian Channel 58°—59° N., 292 m., + 5.83° C. (Appellöf: "Norsk Havfiske" 1905, p. 72); thus, both forms seem to follow the Norwegian Channel and are not necessarily bound to very cold water.

Paratylus Smitti will be mentioned under group 3 D; it perhaps belongs here.

Amphitopsis longicaudata is mentioned here for the sake of completeness; it will be referred to under group 3 E.

Leptamphopus longimanus perhaps belongs, so far as we know, to this group. It has been found namely at "Greenland", locality not stated (Boeck), in Lille Karajak Fjord at Umanak in W. Greenland N. of the ridge (Vanhöffen) and at some places in Norway (Sars "Account"), namely "in the outer part of the Hardangerfjord, at Sunde and Mosterhavn; at Christiansund, and in the Trondhjemsfjord. In all 3 localities it occurred quite solitary in a very considerable depth, ranging from 150 to 400 fathoms.".

Eusirus Holmi has been found at W. Greenland: 66°21′ N., 56° 50′ W., 680 m. and 70°41′ N., 52°07′ W., 386 m. ("Tjalfe" Exped.) and at E. Greenland. 70°32′ N., 8°10′ W., 1°48′ E., 753 m., —1.0° C., 66°41′ N., 6°59′ E., 640 m., —0.9° C. and 80°03′ N., 8°28′ E., 475 m., + 1.1°C. (Norwegian North-Atlantic Exped. — here called erroneously *E. cuspidatus;* see Sars "Account" vol 1, p. 416). Lastly, in the Kara Sea (H. J. Hansen "Dijmphna").

Goësia depressa perhaps belongs here; it will be mentioned under group 3 C.

Erichthonius megalops has been taken at West Greenland, once S. of the ridge (65°11′ N., 33°33′ W., 50 fm.) and 4 times N. of the ridge, 48—183 fm. (H. J. Hansen 1887, Ohlin 1895); at E. Greenland it has been taken at 72°53′ N., 20°36′ W., 96 fm. (H. J. Hansen, 1895). The Norwegian North-Atlantic Expedition took it at 4 places, namely, Jan Mayen, 174 m., —0.6° C., N. W. of Cape Stadt 63°10′ N., 5°0′ E., 763 m., —1.0° C., W. of Lofoten 68°6′ N., 9°44′ E., 1159 m., —1.3° C. and N. of Lofoten 71°25′ N., 15°41′ E., 1134 m., —1.6° C. Lastly, it is recorded by Stebbing (Tierreich) from N. of Finmarken 1217 m.

Neohela monstrosa has been found at Arctic North-America (Sars 2nd "Fram" Exped.) and at W. Greenland outside Umanak Fjord

ca. 71° N.), 122 fm., 72° N., 59°50′ W., 225 fm. (H. J. Hansen 1887) and Murchison Sound in Smith Sound (Ohlin 1895). Further, the Norwegian North-Atlantic Exped. took it at 4 places, namely N. of the Færoes 63°22′ N., 5°29′ W., 2222 m., —1.2° C., W. of Spitzbergen 78° 2′ N., 9°25′ E., 761 m., + 0.8° C., N. W. of Finmarken 71°59′ N., 11°40′ E., 2030 m., —1.3° C., and Porsanger Fjord 70°55′ N., 26°11′ W., 232 m., + 3.5° C. According to Sars ("Account") it is found along the whole of Norway 100—300 fm. and even enters the Kattegat; it thus seems to follow the Norwegian Channel.

Caprella horrida G. O. Sars (= C. spinosissima Norman) is found in arctic America: "Hudson Bay, 20 miles off Churchill, 30 fms." and 72°03′ N., 74°50′ W. (P. Mayer, Siboga Caprellidæ), but does not seem to occur at W. Greenland. On the other hand, it has been taken at E. Greenland: 61°39′ N., 40°35′ W. (P. Mayer l. c.), 72°26′ N., 19°35′ W., 105 fm. and 72°53′ N., 20°36′ W., 96 fm. (H. J. Hansen 1895). Further, at Spitzbergen: Kung Karls Land, Bremersund between the islands, 100—110 m. (P. Mayer l. c.), and 76°34′ N., 12°51′ E., 1359 m., —1.2° C. (Sars: Norwegian North-Atlantic Exped.). Sars (l. c.) gives it also from 5 stations of from W. of Cape Stadt to N. of Lofoten, 755—1134 m., —0.7—1.0° C.; Færoe Channel: 60°31′ N., 9°18′ W., and 60°21′ N., 5°41′ W. (P. Mayer, l. c.). Lastly, it has been taken in the Kara Sea (H. J. Hansen "Dijmphna").

Caprella microtuberculata G. O. Sars var. *spinigera* H. J. H. and *C. dubia* H. J. H. are sometimes thrown together, but are considered two different species by G. O. Sars ("Account" vol 1, p. 665) and P. Mayer (Siboga Caprell. p. 100). As it is not always noted in the literature which species is meant, they are taken together here. They have been found at W. Greenland: 65°35′ W., 54°50′ W., 80 fm. (just S. of the ridge), 66°32′ N., 55°34′ W., 100 fm., 67°59′ N., 56°32′ W., 98 fm. (H. J. Hansen 1887) and Lille Karajak Fjord (ca. 70½° N.) (Vanhöffen). At E. Greenland: 72°26′ N., 19°35′ W., 105 fm. (C. septentrionalis Kr. var. spinigera, P. Mayer = C. microtuberculata G. O. Sars var. spinigera, H. J. Hansen 1895); further, Franz Josephs Land 10—95 fm. (Scott 1899) and Deevie Bay (E. Spitzbergen), 14 fm. (P. Mayer: "Siboga" Caprell.).

Æginella spinosa has been taken at W. Greenland 65°35′ N., 54° 50′ W., 80 fm. (just S. of the ridge) and 68°08′ N., 58°47′ W., 169 fm. (H. J. Hansen 1887). Further at E. Greenland: 74°17′ N., 15°20′ W., 127 fm. (H. J. Hansen 1895). Also at 64°16′ N., 11°15′ W., 198 fm. and Östra Stäggen as well as Norway at North Cape 350 fm.; Tromsø on Brisinga (P. Mayer, "Siboga" Caprell.) and Hammerfest, Bodø, Trondhjems Fjord and Haugesund (Sars "Account"). It thus seems to go some distance into the Norwegian Channel.

Calathura brachiata has probably quite a unique distribution; it perhaps belongs here, but will be discussed under 3E.

Anceus elongatus has been taken at W. Greenland in Lille Karajak Fjord (ca. 71° N.) (Vanhöffen) and E. Greenland: Tasiusak at Angmagsalik 4—11 fm. (H. J. Hansen 1895). Further, by the Norwegian North-Atlantic Expedition S. of Jan Mayen 70 fm. and between Finmarken and Bear Island 191 fm.; also Spitzbergen (Ohlin 1901), Kara Sea (H. J. Hansen "Dijmphna") and Norway N. of Lofoten (Sars: "Account").

Arcturus Baffini is found at W. Greenland and arctic N. America from 65°35' N. (just S. of the ridge) to 82°27′ N., 40—280 fm. (Ives, H. J. Hansen 1887, Sars: 2nd "Fram" Exped., "Tjalfe" Exped.) and E. Greenland at Scoresby Sound 5—25 fm., 72°26′ N. —72°53′ N., 5—100 fm. (H. J. Hansen 1895) and at ca. 77°N., 10—90 fm. (Danmark Exped.). It is also widely distributed in the cold area and at Spitzbergen.

Astacilla granulata is found at W. Greenland 69°16′ N. —72°41′ N., 183—227 fm. (H. J. Hansen 1887). Norman ("Lightning" and "Porcupine" Exped., Ann. Mag. Nat. Hist., ser. 7, vol 14, 1904) and Sars (Norwegian North-Atlantic Exped.) record it from 8 localities in all in the cold area, 220—620 fm., temp. —1° — + 6° C. (the last is given by Sars from 61°41′ N., 3°19′ E., 220 fm.). Quite outside the region it is given by Harger (Report U. S. Commission of Fish and Fisheries, 1880 p. 367) from 3 localities in New England, 7—250 fm.

Janira maculosa is only mentioned here for the sake of completeness, as it has been found within the region, but it can nevertheles hardly be referred to this group; it will be mentioned under 3E.

Ilyarachna hirticeps is known from W. Greenland 66°32′ N. — 72°41′ N., 100—227 fm. (H. J. Hansen 1887). Sars (Norwegian North-Atlantic Exped.) and Ohlin (1901) record it from a number of places at Spitzbergen and in the cold area, 10—1333 fm., —1.2° C. to + 3.5° C.

Eurycope robusta will be mentioned under the group 4B.

Pseudotanais Lilljeborgii has only been found in Lille Karajak Fjord at Umanak, W. Greenland (Vanhöffen) and at Vadsø (N. Norway) 100—200 fm. (Sars: "Account").

Cryptocope arctica has been taken at arctic America (Sars: 2nd "Fram" Exped.), at W. Greenland: 72°20′ N., 59°39′ W., 170 fm. (H. J. Hansen 1887) and at E. Greenland in Stormbugt (ca. 77° N.) 15—20 fm. (Danmark Exped.). Further, in the Kara Sea (H. J. Hansen, "Dijmphna"), and Stebbing mentions, without giving any locality, a specimen in Arctic Crust., Bruce Collection, Ann. Mag. Nat. Hist., ser. 7, vol 5, 1900, p. 12.

Nymphon serratum should probably be placed here. It is known from Baffins Bay and Spitzbergen to Kara Sea; but it has also been

taken in Davis Strait just on the south side of the ridge: 65°35′ N., 54°50′ W., 80 fm. and 66°32′ N., 55°34′ W., 100 fm.

Nymphon elegans has been found in Baffins Bay: 72°40′ N., 57° 15′ W., 118 fm. (Meinert "Ingolf"); it is also distributed over the cold area and goes eastwards to the Kara Sea (H. J. Hansen "Dijmphna"); depth 30—1350 m. ("Fauna arctica"). Meinert ("Ingolf") gives a locality from the Davis Strait: 63°15′ N., 25°20′ W., 270 fm.; this locality is remarkable, as it lies S. of the ridge between Iceland and Greenland.

Boreonymphon robustum has been found in arctic America (Bell, Miers) and at W. Greenland: 66°16′ N., 55°20′ W., 327 fm. (Meinert "Ingolf". Meinert gives 25°20′ W., but this must be 55°20′ W., as he states that the locality lies in the Davis Strait). E. Greenland: 66° 18′ N., 25°59′ W., 330 fm., —0.75° C.; 70°26′ N. (this is probably the same as H. J. Hansen 1895 gives as Scoresby Sound 5—25 fm.) (Meinert l. c.); 72°26′ N., 19°35′ W., 105 fm., 72°53′ N., 20°36′ W., 96 fm. (H. J. Hansen 1895). Further, in the cold area and eastwards to the Kara Sea (H. J. Hansen "Dijmphna"). —

As already mentioned, some of the arctic deep-water Malacostraca go into the Kara Sea, or are even found north of Siberia, so that they are possibly circumpolar. It seems also, from all that we know, that the arctic deep-water Malacostracan fauna is a well-defined group, the species of which are not as a rule found south of the ridges, if we exclude the Norwegian Channel; the number of species occurring in this region are indeed not few (*Bythocaris simplicirostris, Stegocephalus inflatus, Halice abyssi, Aceros phyllonyx, Acanthozone cuspida, Leptamphopus longimanus (?), Neohela monstrosa, Aeginella spinosa, Sphyrapus anomalus*), some indeed right to Bohuslän. Unfortunately, the deep part of the Channel in the Skager Rak is as yet very badly investigated; but there is much to indicate, that we find here remnants of an arctic fauna, yet mixed with a number of Atlantic deep-water species. In "Havbundens Dyreliv" in "Norsk Havfiske" (Norges Fiskerier I, 1905) p. 72—73, Appellöf notes various species from the Norwegian Channel, which elsewhere have their northern boundary much further to the north, but he says nothing as to the origin of the fauna; he writes later however (l. c., p. 115): "That larvae, which come into a boundary region between two currents, may be carried over into the one or the other of these and in this way be brought into a region to which they do not really belong, may be taken as certain, to judge from what we otherwise know regarding pelagic animals, and it is thus a question, how far they can adapt themselves to the new conditions or perish. In the same way I explain the occurrence of the arctic Amphipoda *Epimeria loricata* and *Acanthozone cuspidata* far south in the Norwegian

Channel; the occurrence of these last-mentioned forms in boreoarctic regions shows already, that they can live in water-layers, which form a transition between the Gulf and Polar Streams; with such a mixed layer they can thus be carried into the Norwegian Channel, where they have adapted themselves to more boreal conditions". —

It seems to me of much interest, that there are several species of the cold area which may occur in quite shallow water, if only the temperature is sufficiently low: *Bythocaris simplicirostris* 30 fm. (E. Greenland), *Stegocephalus inflatus* 5—20 fm. (E. Greenland), *Bathymedon obtusifrons* 48 fm. (W. Greenland), *Cleippides quadricuspis* 50 fm. (E. Greenland), *Halice abyssi* 10—20 fm. (E. Greenland), *Erichtonius megalops* 48 fm. (W. Greenland), *Caprella horrida* 30 fm. (Hudson Bay), *Caprella microtuberculata* 10—95 fm. (Franz Josephs Land), *Anceus elongatus* 4—11 fm. (E. Greenland), *Arcturus Baffini* 10—90 fm. (E. Greenland) *Ilyarachna Bergendahli* 20 fm. (Spitzbergen), *Cryptocope arctica* 15—20 fm. (E. Greenland), *Boreonymphon robustum* 5—25 fm. (E. Greenland) and *Colossendeis angusta* 12—18 m. (E. Greenland). It thus appears, that the absolute depth is of no importance or ar least very little, if only the hydrographical conditions, especially the temperature, is suitable. Dr. Th. Mortensen mentions also (Danmark Exped. Echinoderms p. 293) a similar condition among the Atlantic deep-water fauna, as 6 typical, Atlantic-archibenthal Echinoderms are found at the Norwegian coast in 20—60 m.

The fact, that a number of the species of the cold area are found in shallow water at East Greenland seems to me to suggest an explanation of the conditions in the arctic deep basin at West Greenland. Dr. Mortensen writes certainly (l. c., p. 293) that "the Polar Deep-Sea is so sharply separated from the Baffin basin through the shallow waters in Smith Sound and the other sounds to the North of Baffin Land, that a direct communication of the deep-sea fauna of the Polar Sea with that of the Baffin Sea is excluded. If a nearer relation between the deep-sea faunas of these two regions proves to exist, it must be due to a more direct communication in a former period." But when so many species comparatively can live in relatively shallow water, it cannot be denied, that the connection between the animal-world of the two seas, in spite of the shallow depth in Smith Sound, must be considered probable. *The deep-sea animals of Baffins Bay must have wandered in from the depths of the Polar Sea through Smith Sound and the other sounds N. W. of Greenland.*

Some of the certainly arctic, deep-water Malacostraca are found (apart from the Norwegian Channel) outside the southern boundary of the region. A few are taken in Davis Strait south of the ridge:

Erichthonius megalops 65°11' N., 53°33' W., 50 fm., *Caprella microtuberculata, Aeginella spinosa, Arcturus Baffini* and *Nymphon serratum* 65° 35' N., 54°50' W., 80 fm. and *Colossendeis proboscidea* 65°27' N., 54°45' W., 67 fm.), thus close at least to the arctic and boreal transition-region. Other species are found much further away from the boundary: *Stegocephalus inflatus* in Arsuk Fjord (ca. 61° N., West Greenland), *Ischyrocerus megacheir* at Newfoundland and *Astacilla granulata* and *Colossendeis angusta* at New England. *Parapleustes latipes* (p. 571) has a distribution, which seems to me quite inexplicable.

2. The Atlantic (boreal) deep-water fauna.

This group embraces the species which are distributed in the deep Atlantic and have their northern boundary at the ridge Shetland — Færoes — Iceland — Greenland — Baffin Land. Some however go with the warm water along the Norwegian coast to Finmarken, Bear Island or Spitzbergen. A few are also found in the Pacific.

The species are the following:

Neolithodes Grimaldii.
Paralomis spectabilis.
— Bouvieri.
Munida tenuimana.
Galacantha rostrata.
Munidopsis Antonii.
— curvirostra.
— similis.
Polycheles nanus.
Sabinea hystrix.
Pontophilus norvegicus.
Glyphocrangon sculptus.
Spirontocaris Lilljeborgii.
Bythocaris gracilis.
Pandalus borealis.
— propinquus.
? Epimeria loricata.
Nicippe tumida.
Cleonardo microdactylus.
Anthelura abyssorum.
Apseudes gracilis.
Alaotanais (Neotanais) hastiger.
Sphyrapus malleolus.
Ingolfiella abyssi.
Leucon longicostris.
— serratus.
Diastylis armata.
Cordylochele longicollis.
Pallene acus.
— hastata.
Nymphon Hoekii.
— groenlandicum.
— macrum.
? — brevitarse.
? Chaetonymphon tenellum.
Paranymphon spinosum.
Colossendeis colossea.
— macerrima.

Neolithodes Grimaldii has been taken in Davis Strait, S. W. of Iceland and at E. America N. of 40° N., 410—1230 fm., 3.3°—3.4° C.

Paralomis spectabilis has been found 3 times between S. Greenland and Iceland, and one S. of Iceland, 735—1041 fm.. 1.2°—3.1° C.

Paralomis Bouvieri has been taken between S. Greenland and Iceland, and S. of Iceland, 735—795 fm., 1.2°—3.1° C.

Munida tenuimana goes northwards in the Davis Strait to 65°16′ N., 55°05′ W., 362 fm., 3.6° C.; it is also found W. S. W. and S. E. of Iceland, S. W. of the Færoes, in the Norwegian fjords from 60°—68° N. and in the Skager Rak (390—660 m.). In the S. it goes possibly to N. Africa.

Galacantha rostrata has been found midway between E. Greenland and Iceland: 64°34′ N., 31°12′ W., 1300 fm., 1.6° C. It seems to be cosmopolitan, as it is distributed from the Antilles northwards to 40°17′ N., at N. Africa (30° N.), in the Arabian Sea, Indian Ocean (Bay of Bengal, Banda) and Pacific (W. Columbia, Galapagos Islands).

Munidopsis Antonii has been taken by the "Ingolf" in the mouth of the Davis Strait: 61°50′ N., 56°21′ W., 1435 fm., 1.5° C. It has also been found at the Azores; ca. 2100 fm., W. of Valparaiso 1375 fm. and S. W. of Australia, 1800 fm.; it thus seems to be cosmopolitan like the preceding species.

Munidopsis curvirostra has repeatedly been taken in the Davis Strait south to 65°36′ N., down to 1100 m. ("Ingolf" and "Tjalfe"); it is found further S. W. and S. of Iceland, 800—975 fm.; eastern North America 46°—33° N., 384—1230 fm. and Soudan (30° N.) 1104—1175 fm. The temperature at the "Ingolf" stations was 3.0°—4.1° C.

Munidopsis similis has been found at E. Greenland 64°34′ N., 31° 12′ W., 1300 fm., 1.6° C. ("Ingolf"). Further, on the east coast of America 39°46′ N.—36°16′ N., 1060—2574 fm.; perhaps also W. of Patagonia 1450 fm.

Polycheles nanus has been taken in the mouth of the Davis Strait 61°50′ N., 56°21′ W., 1435 fm., 1.5° C. and W., S. W. and S. of Iceland, 685—1245 fm.. 2.0°—4.2° C. ("Ingolf"). Further, east of America 35°—41° N., 707—1917 fm., Gulf of Gascony 355 fm., Cape Point (S. Africa) 750—800 fm.; also west of America 0°36′ S.— 7$^{1}/_{4}$° N., 899—1522 fm.

Sabinea hystrix has been taken in the Davis Strait 64°05′ N.—65°14′ N., 293—600 fm., 3.5°—3.8° C. ("Ingolf", "Tjalfe") and S. W. of Iceland: 62°25′ N., 28°30′ W., 1912 fm., 3.5° C. ("Ingolf"). Further, east of America 35°45′ N. —41°53′ N., 353—888 fm. and Guadeloupe 734 fm.

Pontophilus norvegicus is widely distributed W. and E. of Greenland and occurs W., S. W., S. and S. E. of Iceland, 80—589 fm., 3.2°—8.4° C. Further, at E. America 38$^{1}/_{2}$°—44° N., between the Færoes and the Hebrides, the whole coast of Norway from the western part of the Murman Coast to and including Kristiania Fjord; S. W. of Spitzbergen 186 fm., 2.7° C. and Gulf of Gascony 425—638 fm.; W. Ireland.

Glyphocrangon sculptus has been taken at E. Greenland 64°84′ N., 31°12′ W., 1300 fm., 1.6° C. ("Ingolf"); further, at E. America 37°50′—41°10′ N., 1098—1395 fm.; Cape Point (S. Africa) 750—800 fm.

Spirontocaris Lilljeborgi enters somewhat into the arctic region, having been taken, though seldom, at W. and E. Greenland. At E. America it occurs from Nova Scotia to 37° N. In Europe it goes southward to Firth of Forth and Kattegat. Occurs further N. of Alaska. See further: Appellöf, Die decapod. Crust., Meeresfauna von Bergen, Heft 2—3, 1906, p. 170.

Bythocaris gracilis is only known from Davis Strait 65°14′ N., 55°42′ W., 420 fm., 3.5° C. and 64°54′ N., 55°10′ W., 393 fm., 3.8° C. ("Ingolf"), and eastern N. America between 39½° N., 1043 fm., and 35¾° N., 888 fm., 3.9° C. See also Appellöf l. c. (under preceding species) p. 167.

Pandalus borealis is found at W. Greenland and goes northwards to Umanak Fjord (70°42′ N.), thus ca. 5° further north than the ridge; so far as we know at present, alone with *Pseudomma parvum* (Group 4 B) it composes the only two Atlantic deep-water species which pass to the other side of the ridge, but in Umanak Fjord, as mentioned above, the bottom-temp. is positive (+ 1° C.). Its northernmost place of occurrence at E. Greenland is Angmagsalik (65°39′ N.) 140 fm. To the east it goes to the Kara Sea. Its southern boundary on the American side is at Cape Cod; in Europe the southern boundary is Northumberland (E. N. E. of Croquet lighthouse, 57 fm.; Norman, Transact. Hertfordshire Nat. Hist. Soc., vol 14, part 1, 1909, p. 27), Skager Rak and Kattegat (Ad. Jensen, Dansk Fiskeritidende 1903, pp. 341—43). It may occur at less depths than 100 fm., but lives mostly much deeper; is commonest in the boreal part of its region of distribution; for example, it is so abundant in Kristiania Fjord, that it forms the object of a regular fishery (Wollebæk, Ræker og rækefisket, Aarsberetning ved. Norges fiskerier, 2. Hæfte, 1903). It is also found in the Pacific N. of 46° N.

Pandalus propinquus is found at E. Greenland up to 66°35′ N., 318 fm.; W., S. W. and S. of Iceland at many places; S. of the Færoes, W. Scotland, Norway S. of 69½° N.; the southern boundary on the American side lies at 39⅕° N., in Europe in the Skager Rak. A true deep-water form which may go right down to 1089 fm.

Epimeria loricata perhaps belongs here; will be mentioned under Group 3 E.

Nicippe tumida has been taken at "Greenland?" (H. J. Hansen 1887), Shetland, Norway S. of Lofoten 60—300 m. and off Cape Finisterre 363—510 m. (Chevreux, Hirondelle 1900).

Cleonardo microdactylus has been taken by the "Tjalfe" 64°06′ N., 55°18′ W., 1040—1100 m., 1200 m. wire out.

Anthelura abyssorum has only been taken at the entrance to the Davis Strait 59°10′ N., 50°25′ W., 1750 fm. (Norman, Valorous Exp.).

Alaotanais (Neotanais) hastiger is only known from the same locality, as also

Apseudes gracilis, which has also been taken however a little further south, namely 55°10′ N., 25°58′ W., 1785 fm. and 56°11′ N., 37°41′ W., 1450 fm. (Norman, Valorous Exped.).

Sphyrapus malleolus should probably be included in the Greenland fauna, though its nearest locality certainly lies very far from Greenland. Norman and Stebbing give it (Transact. Zool. Soc. London, vol 12, 1886, p. 98) from the following places: S. of Cape Farewell 57°11′ N., 37°41′ W., 1450 fm.; S. of Rockall 56°08′ N., 13°34′ W., 1263 fm. and 56°26′ N., 14°28′ W., 109 fm.; W. of Portugal 39°39′ N., 9°39′ W., 740 fm. Further, it is noted by Bonnier (Ann. Univ. Lyon, vol 26, 1896, p. 665) from 45°57′ N., 6°12′ W.

Ingolfiella abyssi is only known from 59°12′ N., 51°05′ W., 1870 fath, 1.3° (H.J. Hansen, Journal Linn. Soc., Zool. vol 29, 1903, p. 118).

Leucon serratus and *Diastylis armata* have only been taken at the same locality as *Anthelura abyssorum* (see above).

Leucon longirostris has been taken at the same place, but further at Portugal: 37°07′ N., 9°18′ W., 550 fm. (Sars, "Josefines" Cumac).

Cordylochele longicollis has been taken at Nordland and Lofoten 182—218 m. (Sars), S. W. to Iceland 1129 M and at W. Greenland: 64°54′ N., 55°10′ W., 393 fath., + 3.8° C. (Meinert "Ingolf").

Pallene acus has only been taken at W. Greenland 63°06′ N., 56° 00′ W., 1199 fm. (2237 m.), 2.4° C. (Meinert "Ingolf").

Pallene hastata is only known from 61°50′ N., 56°21′ W., 1435 fm., 1.5° C. (Meinert "Ingolf").

Nymphon Hoekii is also known only from a single locality, namely E. Greenland: 65°14′ N., 30°39′ W., 752 fm. 2.1° (Meinert "Ingolf").

Nymphon macrum is recorded by the "Ingolf" Exped. from 5 stations in the Davis Strait and 2 stations in Danmark Strait 35—465 fm., 0.8°—6 1° C.; the northernmost station at W. Greenland lies on the ridge 67°57′ N., 55°30′ W., 35 fm., 0.8 C. Further, it has been taken at eastern N. America (Wilson) and along the coast of Norway as well as E. of Varanger Fjord 70°36′ N., 32°35′ E., 271 m., 1.9° C. and between Finmarken and Bear Island 72°27′ N., 20°51′ E., 349 m., 3.5° C. (Sars: Norwegian North-Atlantic Exped.).

Nymphon brevitarse perhaps belongs here; will be mentioned under Group 3 C.

Nymphon groenlandicum has only been taken 64°54′ N., 55°10′ W., 395 fm., 3.8° C. ("Ingolf").

Chætonymphon tenellum is included here, though its position is not quite certain. In the Norwegian North-Atlantic Exped. Sars records 2 specimens from W. of Finmarken 71°25′ N., 15°41′ E., 1134 m., —1.0° C. and states, "as this station lies in the cold area, the species must unquestionably be regarded as a true arctic form." The "Ingolf" localities are opposed to this however: W. of the Færoes 61°42′ N., 9°36′ W., 545 fm., 4.8° C.; S. of Iceland 63°13′ N., 15° 41′ W., 600 fm., 4.5° C., and W. Greenland 65°14′ N., 55°42′ W., 420 fm., 3.5° C. This is the only material as yet, but it thus seems to be a boreal deep-water form, which however can also live in negative temperatures.

Paranymphon spinosum has been taken 63°30′ N., 54°25′ W., 582 fm., 3.3° C. and 64°56′ N., 36°19′ W., 204 fm., 4,1° C. (Meinert "Ingolf") and Golfe de Gascogne 650—1710 m. (Caullery: Ann. Univ. Lyon 1896).

Colossendeis colossea has been found E. of Greenland 64°34′ N., 31°12′ W., 1300 fm., + 1.6° C. and 61°44′ N., 30°29′ W., 1135 fm., + 3.0° C. (Meinert "Ingolf"); further, eastern N. America between 38°45′ N. and 41°33′ N. and from 65°47′ W. to 73°10$^1/_2$′ W., 523—1186 fm. (Wilson "Blake").

Colossendeis macerrima has been taken: E. Greenland 64°34′ N., 31°12′ W., 1300 fath., + 1.6° C. (Meinert, "Ingolf") at N. America 38°18′ N., 1685 m. (Wilson), Brede Bugt (W. Iceland) 76 fath. (Meinert, l. c.) and (?) Golfe de Gascogne, 1710 m. (Caullery, Ann. Univ. Lyon 1896, p. 362).

3. Littoral fauna.

This fauna can be subdivided into an arctic and a boreoarctic group. A number of the species are found at Finmarken, but no further south on the coast of Norway; when the main distribution is arctic, however, the species are considered here as arctic, even though Finmarken is boreal.

The arctic littoral fauna may be divided into the following subgroups: 3 A endemic, West Greenland species (there are no endemic East Greenland species); 3 B endemic, Greenland species; 3 C species which range from West Greenland to Spitzbergen or further east, but are not found N. of Siberia; 3 D species which range from West Greenland over Spitzbergen to and including Siberia and are thus probably circumpolar.

The boreoarctic littoral fauna embraces the species which in Europe have their southern boundary south of Finmarken; a number range to France, a few to the Azores. This fauna may be divided into two groups 3 E. and 3 F, corresponding to 3 C and 3 D.

3A. Endemic West Greenland littoral species.

(4 species: *Metopa carinata, Janira spinosa, Campylaspis and Eudorellopsis integra* are also found in arctic North America).

Spirontocaris microceros.	? Paramphithoe Boeckii.
Anonyx affinis.	? — gracilis.
Tryphosa pulchra.	Parapleustes Olrikii.
Prinassus Nordenskioeldii.	Rhachotropis oculata.
? Priscilla armata.	Melita amoena.
Metopa groenlandica.	Podoceropsis Lindahlii.
— carinata.	Siphonocoetes typicus.
Paroediceros curvirostris.	Janira spinosa.
Monoculodes crassirostris.	Janthe libbeyi.
— simplex.	Campylaspis carinata.
	Eudorellopsis integra.

Spirontocaris microceros is found from Nanortalik (60°08′ N.,) to Prøven (72°23′ N.).

Anonyx affinis has only been found at Cape Dudley Digges (N. of Cape York) 17—25 fm. (Ohlin 1895).

Tryphosa pulchra occurs from Sukkertoppen (ca. 66° N.) 100 fm. to Christianshaab (ca. 68½° N.) 15—30 fm.

Prinassus Nordenskioeldii is only known from the two localities mentioned under the previous species.

Priscilla armata has been taken in Davis Strait and at 68°9′ N., 56°32′ W., 48 fm. Sars ("Account") gives it as possibly taken in Søndfjord (W. Norway).

Metopa groenlandica has been found from Godthaab (ca. 64° N.) to Nordfjord on Disko (70° N.) 25 fm.

Metopa carinata is very common from Frederikshaab (ca. 62° N.) to Prøven (ca. 72° N.); the depth most often ca. 10 fm. (H. J. Hansen 1887 and Vanhöffen 1897). According to G. O. Sars (2nd "Fram" Exped.) it goes right up to Ren Bay, Ellesmere Land.

Paroediceros curvirostris has been taken at 63°35′ N., 52°57′ W., 43 fm. and Godthaab (ca. 64° N.) 6—40 fm.

Monoculodes crassirostris has been taken only in the Davis Strait, locality not mentioned.

Monoculodes simplex is known from Frederikshaab (ca. 62° N.) 10—25 fm. to Claushavn (ca. 69° N.) 20 fm.

Paramphithoe Boeckii has been taken from Godthaab (ca. 64° N). ca. 40—60 fm. to Egedesminde (ca. 68½ N.) 10—20 fm. Sars ("Account") states that it is perhaps found at Norway.

Paramphithoe gracilis is found at Upernivik (ca. 73½° N.) 3—10 fm. (H. J. Hansen 1887). It is a doubtful species, perhaps the same as

P. brevicornis G. O. Sars (*teste* Stebbing, Tierreich p. 313), perhaps *Parapleustes glacitis* Buchholz (*teste* l. c., p. 320). *P.* (*Neopleustes*) *brevicornis* has been taken at Finmarken 20—30 fm. (Sars, "Account"), *P. glacilis* at Sabine Island (E. Greenland) 10 fm. (Buchholz).

Parapleustes Olrikii has only been found at Prøven (ca. 72° N.) 94 m.

Rhachotropis oculata has been taken from 63°35′ N., 45 fm. to Jacobshavn (ca. 69° N.) 10—35 fm.

Melita amoena is only known from Ikertokfjord (ca. 67° N.) 30 fm.

Podoceropsis Lindahlii has only been taken at 69°09′ N., 56°32′ W., 91 m.

Siphonocoetes typicus is known from the same locality and further probably from Godthaab.

Janira spinosa (= ? *J. speciosa*) has been taken at Banquerau in New England (Harger 1879) and at W. Greenland: 65°35′ N., 54°50′ W., 80 fm., 66°32′ N., 55°34′ W., 100 fm. and 67°59′ N., 56°33′ W., 98 fm. (H. J. Hansen 1887 and Bovallius 1886); the last locality refers to *J. speciosa*.

Janthe (*Tole*) *libbeyi* is only known from Cape Alexander, Smith Sound (ca. 78° N.), 27 fm. (Ortmann 1901).

Campylaspis carinata is found in Nordfjord (Disko), 25 fm. (H. J. Hansen 1887) and at arctic N. E. America, locality not stated (Sars, 2nd "Fram" Exped.).

Eudorellopsis integra has been found at W. Greenland at 5 places from 68°9′ N. to ca. 70° N., 15—280 fm. (H. J. Hansen 1887 and Vanhöffen 1897). S. J. Smith (1878) mentions it from the Gulf of Lawrence and Halifax. —

Close to this group come 3 species which are found at W. Greenland and America N. of Cape Cod, but also in the Pacific. These are: *Chionoecetes opilio, Spirontocaris Fabricii* and *Sp. macilenta.*

Chionoecetes opilio is known from W. Greenland 66°35′ N. — 70°42′ N., 5—350 fm. At eastern N. America it is found from Newfoundland to Casco Bay, Maine; further, N. and S. of Bering Strait ("Ingolf") and the Copenhagen Zoological Museum obtained a specimen from Mr. James Jordan from Nagasaki in the summer of 1911. Regarding a statement of its occurrence at W. Greenland at 350 fm. H. J. Hansen writes ("Ingolf" p. 13), that this depth is very unusual; from the available material the species certainly seems to be essentially a littoral form, but the "Tjalfe" has nevertheless taken it in Davis Strait at ca. 175 fm. and 220—280 fm.

Spirontocaris Fabricii is distributed at W. Greenland from 60° 43′ N. to 72°23′ N. and has been taken on the west side of Davis Strait at 64°56′ N., 66°18′ W. W. (Ohlin 1895). Its southern boundary lies at Cape Cod. In addition to this Western Atlantic region

it is also found N. and S. of Bering Strait. The usual depth is 2—50 fm.

Spirontocaris macilenta is known from W. Greenland: Fiskenæsset (ca. 63° N.) (Krøyer), 66°44′ N., 56°08′ W., ca. 175 fm., 69°29′ N., 52° 56′ W., 75 fm. and 69°59′ N., 55°26′ W., 116 fm. ("Tjalfe" Exped.); it thus seems on the whole rare at W. Greenland. It is found further at E. America: Halifax, Nova Scotia 26—57 fm., St. Lawrence estuary 30—70 fm. and Labrador. W. of America it occurs in Bering Strait, Bering Sea towards the American side, at Kamtschatka and in the Sea of Ochotsk 16—100 fm.

3B. Endemic Greenland littoral species.

There are only two species here (common to W. and E. Greenland), namely, *Amphitopsis* (*Halirages*) *megalops* and *Ischyrocerus latipes*.

Amphitopsis megalops is very common at W. Greenland from Godthaab (ca. 64° N.) to Upernivik (ca. 72$^1/_2$° N.) (H. J. Hansen 1887, Vanhöffen 1897); it has been taken further in Smith Sound (Ortmann 1901). On E. Greenland it occurs from Angmagsalik (ca. 67° N.) to Danmarks Havn (ca. 77° N.) (Buchholz, H. J. Hansen 1895, Danmark Exped.).

Ischyrocerus latipes is found at W. Greenland from Godthaab (ca. 64° N.) to Kekertak (ca. 70° N.) (H. J. Hansen 1887) and at E. Greenland in Scoresby Sound (H. J. Hansen 1895).

The 2 following species may be taken as coming nearest to this group.

Nectocrangon lar is very common at W. Greenland and has also been taken at E. Greenland (70°27′ N. —ca. 77° N.) (H. J. Hansen 1895, Danmark Exped.), but it is also found both N. and S. of Bering Strait and goes S. to Vancouver Island and the Kurilles.

Spirontocaris groenlandica is found at arctic N. America (Sars: 2nd "Fram"-Exped.) and is probably common along the whole of the Greenland coast, both to the west and east, but is not found at Jan Mayen, the Færoes or Iceland. At E. America the southern boundary lies at Cape Cod. A record from Christianssund (Norway; G. O. Sars: Oversigt af Norges Crust., Forh. Vid. Selsk., Christiania 1882) is probably not correct. W. of America it is found both N. and S. of Bering Strait.

3C. Arctic littoral species occurring from Greenland to Spitzbergen or further east, but not N. of Siberia and in Norway not S. of Finmarken.

Sclerocrangon boreas.	Hippomedon Holboelli.
Socarnes bidenticulatus.	Aristias tumidus.

Anonyx nugax.
Orchomenella groenlandica.
? Gitanopsis (Amphilochus) inermis.
Amphilochus oculatus.
Metopa clypeata.
— borealis.
— latimana.
— glacialis.
? Bathymedon obtusifrons.
Aceroides latipes.
Parapleustes pulchellus.
? — glacilis.
Acanthonotosoma inflatum.
Apherusa glacialis.
— megalops.
Cleippides tricuspis.
Eusirus cuspidatus.
? Goësia depressa.
Dulichia spinosissima.
? Caprella dubia.
? — microtuberculata var. spinigera.
Janira tricornis.
Clypeoniscus Meinerti.
Diastylis resima.
— spinulosa.
— Goodsirii.
Cordylochele brevicornis.
Pseudopallene spinipes.
? Nymphon brevitarse.
? — longimanum.
? — Sluiteri.

Sclerocrangon boreas has a very wide arctic distribution; it ranges from arctic N. America (Sars, 2nd "Fram" Exped.) over Greenland to Kara Sea, which however it does not enter, and it hardly occurs N. of Siberia; in the S. it goes to Cape Cod.

Socarnes bidenticulatus is found at arctic America (Sars, 2nd "Fram" Exped.), W. Greenland from Sukkertoppen (ca. 66° N.) to Baffins Bay (H. J. Hansen 1887, Ohlin 1895, Vanhöffen 1897), E. Greenland ca. 77 N. (Danmark Exped.), Jan Mayen (Koelbel), N. W. Spitzbergen (Magdalene Bay) 40—60 fm. (Sars, "Norwegian North-Atlantic Exped."), Barents Sea 13—60 fm. (Stebbing, Bijdragen .... Dierkunde) 124—160 fm. (Hoek), Kara Sea (H. J. Hansen, "Dijmphna").

Hippomedon Holboelli is found at W. Greenland at Godthaab (ca. 64° N.), but has not been taken at E. Greenland; on the other hand, it is known from Jan Mayen, Spitzbergen, Murman Coast, White Sea and Matotschin skar, but not at Norway (Sars, "Account").

Aristias tumidus occurs at several places at W. Greenland (H. J. Hansen 1887 and "Tjalfe"); further, at Spitzbergen, Franz Josephs Land, Varanger Fjord; E. of Bear Island 147 fm. (Sars, "Norwegian North-Atlantic Exped.), Newfoundland Bank 46°50′ N., 50°11′ W., 155 m. (Chevreux, Hirondelle 1900).

Anonyx nugax is an arctic species, but its distribution cannot be exactly fixed from the literature, as it has earlier often been mixed with the boreal *A. lagena* Kr. (cf. Sars, "Account", vol 1, p. 686).

Orchomenella groenlandica has been taken at W. Greenland, Sukkertoppen (ca. 66° N.) 15—20 fm. and Egedesminde (ca. $68^1/_2$° N.)

10—20 fm. (H. J. Hansen 1887); further, at E. Greenland ca. 77° N. (Danmark Exped.) and Finmarken 20—30 fm. (Sars, "Account").

Gitanopsis (*Amphilochus*) *inermis* perhaps does not belong here; it has only been taken in Lille Karajakfjord in W. Greenland (ca. 70½° N.; Vanhöffen 1897) and at Vadsö in Finmarken 20—50 fm. (Sars, "Account").

Amphilochus oculatus has been taken at W. Greenland at Godthaab (ca. 64° N.) and at Sukkertoppen (ca. 66° N.), 5—10 fm.; E. Greenland in Hekla Havn (70°27′ N.) 5—12 fm. (H. J. Hansen 1895) and at Franz Josephs Land (Scott 1899).

Metopa clypeata has been taken at W. Greenland at Godthaab (ca. 64° N.) 40—60 fm. and perhaps at Bell Sound, Spitzbergen.

Metopa borealis has been taken at Gaasefjord (arctic America, Sars, 2nd "Fram" Exped.) and at Godthaab in W. Greenland (ca. 64° N.) 40—60 fm.; further, at one place in Norway, possibly the west coast or Finmarken (Sars, "Account").

Metopa latimana has been taken at W. Greenland 65°35′ N., 54° 50′ W., 80 fm. If it is synonymous with *M. affinis* Boeck, it has also been found at Norway (Sars "Account").

Metopa glacialis is known from W. Greenland: Prøven (ca. 72½° N.) 16—40 fm. and Augpalartok (ca. 73° N.); further, from Iceland and Spitzbergen.

Bathymedon obtusifrons perhaps belongs here; it has already been mentioned under group 1 C.

Aceroides latipes is found at W. Greenland from Sukkertoppen (ca. 66° N.) ca. 60 fm. to Umanak Fjord (ca. 71° N.); from Jacobshavn (ca. 69° N.) it is given from a depth of 350 fm. (H. J. Hansen 1887); E. Greenland: Hekla Havn (70°27′ N.) (H. J. Hansen 1895); further, it is known from Spitzbergen, Finmarken and the Kara Sea.

Parapleustes pulchellus is known from W. Greenland: 71°10′ N., 58°56′ W., 200 fm.; further, from Iceland, Spitzbergen and Finmarken (50—100 fm.).

Parapleustes glacilis perhaps belongs here; it has been mentioned earlier under *Paramphithole gracilis* (Group 3 A., p. 583).

Acanthonostoma inflatum is known from W. Greenland from 66° 59′ N., 57 fm., to Lille Karajakfjord (ca. 70½° N.) (H. J. Hansen 1887, Vanhöffen 1897, "Tjalfe"). Further, Spitzbergen, Franz Josephs Land, White Sea, Kara Sea, Matotschin skar.

Apherusa megalops is known from E. Greenland, locality not known (H. J. Hansen 1895) and from Varanger Fjord 50—60 fm.

Apherusa glacialis has been taken at arctic America, locality not stated (Sars, 2nd "Fram" Exped.). W. Greenland: 60°07′ N. — 62°

58′ N. ("Tjalfe"), Godhavn (ca. 69° N.) and 69°40′ N. (H. J. Hansen 1887), Baffins Bay (Ohlin 1895). From E. Greenland it is known from Hekla Havn (70°27′ N.), 74°36′ N. (H. J. Hansen 1895), 75°47′ N. — ca. 77° N. (Danmarks Exped.) It is known further from Franz Josephs Land (Scott 1899), Matotschin skar (Stebbing 1894) and several places in the Polar Sea (Sars in Nansen, "Norwegian North-Polar Exped." vol 1, 1900); Kara Sea from the stomach of Liparis sp. (H. J. Hansen, "Dijmphna"). This species seems to live, at least fairly often, at the surface among the drift-ice.

Cleippides tricuspis has been taken at W. Greenland: Sukkertoppen 66°8′ N., 60—70 fm.; further at Spitzbergen.

Eusirus cuspidatus has been taken at arctic America, locality not stated (Sars, 2nd "Fram" Exped.) and at W. Greenland from 63°35′ N. to 79°29′ N. At E. Greenland it has been taken at Sabine Island (Buchholz). It is known further from Jan Mayen (Koelbel), Franz Josephs Land (Scott 1899) and Polar Sea 84° N., 134° E. (Sars in Nansen "Norw. North-Polar Exped.", vol 1, 1900). The locality given by Sars in "Norw. North-Atlantic Exped." does not refer to this species, but to *E. Holmii* (see Sars "Account", vol 1, p. 416).

Goësia depressa is known from W. Greenland: Jacobshavn (ca. 69° N.) 120 fm. and Umanak Fjord (ca. 71° N.) 122 fm. Further, from Spitzbergen 9 m (Goës). This species should perhaps not be included in this group, as from the places where it has been found it might just as well be referred to the deep basin N. of the ridge in Davis Strait plus the cold area with coasts.

Dulichia spinosissima is known from W. Greenland from 60°11′ N. to Prøven (ca. 72° N.) and Baffins Bay (Ohlin 1895); further, from Franz Josephs Land (Scott 1899), Spitzbergen and Finmarken (Sars "Account").

Caprella dubia, which as a rule is mixed with *C. microtuberculata var. spinigera*, perhaps belongs here; it has already been mentioned under 1 C.

Janira tricornis has been found at arctic America (Sars 2nd "Fram" Exped.) and at W. Greenland from ca. 62° N. to ca. 68½° N., 5—70 fm. It is not known from E. Greenland, but has been taken at Jan Mayen (Koelbel); further, between Bear Island and Hope Island, 75°49′ N., 24°25′ E., 80 m., —1.4° C. and at King Charles Island (Spitzbergen) 78°50′ N., 27°39′ E., 20 m., + 0.2° C. (Ohlin 1901). Sars ("Norweg. North-Atlantic Exped.") gives it from S. of Spitzbergen 76°19′ N., 15°42′ E., 128 m., 0.4° C.

Clypeoniscus Meinerti is known from W. Greenland (Godhavn)

and Jugor Schar, Nova Zembla 6—10 fath. (Giard et Bonnier, Bull. Scient. France et Belgique, ser 4, vol 25, 1893, p. 421).

Diastylis resima is known from Baffins Bay, and H. J. Hansen (1887) mentions some specimens from Krøyer's time from "Greenland", locality not stated. At E. Greenland it has been taken in Hekla Havn (70°27′ N.) (H. J. Hansen 1895); further at Spitzbergen, Nova Zembla and west coast of the Samoyede Peninsula.

Diastylis spinulosa has been taken at W. Greenland from 65° 11′ N. right up in Murchison Sound, Smith Sound (H. J. Hansen 1887, Ohlin 1895, "Tjalfe") and at E. Greenland in Scoresby Sound (Ohlin 1901). It is also known from Spitzbergen, Barents Sea, Franz Josephs Land, Finmarken, Nova Zembla, Kara Sea, west coast of the Samoyede Peninsula and N. of the mouth of the Jenissei; it is thus possibly circumpolar like the next species.

Diastylis Goodsirii is known from arctic America and at W. Greenland from 65°35′ N., right up in Smith Sound (H. J. Hansen 1887, Ohlin 1895, Ortmann 1901, "Tjalfe"); at E. Greenland it has been taken from 70°43′ N. to 74°10′ N. (Ohlin 1901). It is also known from Jan Mayen, Spitzbergen, Barents Sea, Porsanger Fjord, Vadsø, Kara Sea, west coast of Samoyede Peninsula and N. of the mouth of the Jenissei.

Cordylochele brevicollis, *Nymphon longimanum* and *N. Sluiteri* are known from E. Greenland to the Kara Sea (Lönnberg 1903, Stuxberg's "Vega", and "Fauna arctica").

Pseudopallene spinipes seems from the available material to live at the coasts of Greenland and of the cold area, where it is widely distributed; it goes down to 380 m. however and is found in the Kara Sea.

Nymphon brevitarse has a similar distribution to the preceding, but has been found by the "Ingolf" at 2 stations just S. of the ridge between Iceland and Greenland in very deep water, namely, 65° 14′ N., 30°39′ W., 752 fm., 2.1° C. and 65°24′ N., 29°00′ W., 735 fm., 1.2° C.

3D. Arctic littoral species which are found from Greenland eastwards as far as E. Siberia and are thus probably circumpolar.

Alibrotus littoralis.	Rhachotropis fragilis.
Harpinia plumosa.	Melita Goësii.
? Acanthostepheia Malmgrenii.	Gammaracanthus loricatus.
Oediceros saginatus.	Amathilla pinguis.
— borealis.	Unciola leucopis.
Paroediceros lynceus.	Glyptonotus Sabini.
? Paratylus Smittii.	Dajus mysidis.
Rhachotropis aculeata.	

Alibrotus littoralis is distributed right from arctic America over Greenland and Spitzbergen to Siberia.

Harpinia plumosa has the same distribution, but is also found at eastern N. America, though not at the northern arctic America. It also occurs perhaps at Norway (Sars: "Account").

Acanthostepheia Malmgrenii is found at arctic N. America, locality not stated (Sars: 2nd "Fram." Exped.) and in Murchison Sound, Smith Sound (Ohlin 1895). At W. Greenland it has been taken in Umanak Fjord (H. J. Hansen 1887); E. Greenland 69°25′ N., 20°01′ W., 167 fm. (H. J. Hansen 1895); Spitzbergen (Goës), Franz Joseph Land (Scott 1899), Barents Sea (Stebbing), Kara Sea and the whole of the Siberian Polar Basin, "where it has its true region of distribution" (Stuxberg, Bihang ..... vol 5, 1880, p. 37).

Oediceros saginatus has the same distribution, but has not yet been found at arctic America.

Oediceros borealis is known from W. and E. Greenland (Buchholz, Boeck, H.J.Hansen 1887), Finmarken (Sars "Account"), Siberia (Stuxberg).

Paroediceros lynceus. "No doubt often confused with *P. propinquus*, so that notices of localities and depths are exposed to some uncertainty" (Stebbing, "Tierreich", p. 246). It is noted from arctic America (Ohlin 1895, Ortmann 1901 and Sars 2nd "Fram" Exped.); W. Greenland widely distributed from Friederichsthal (ca. 60° N.) to Ivsugiksok (ca. 76° N.) (H. J. Hansen 1887). At E. Greenland it has been taken in Hekla Havn (70°27′ N., H. J. Hansen 1895), Sabine Island, Germania Havn (ca. 74½° N., Buchholz) and at 9 places at Danmarks Havn, (ca. 77° N., Danmarks Exped.) Further, at Iceland, Newfoundland (Chevreux, Hirondelle 1900), Spitzbergen (Goës), Franz Josephs Land (Scott 1899), Finmarken, Murman Coast, Kara Sea, Siberia.

Paratylus Smittii ranges from W. and E. Greenland over Spitzbergen, Finmarken, Barents Sea and Kara Sea to Siberia. As some of the places recorded lie over deep water, e. g. 69°16′ N., 58°8′ W., 183 fm. (H. J. Hansen 1887) the species is perhaps a deep-water species belonging to the Group 1 C.

Rhachotropis aculeata is certainly a circumpolar species (Stebbing "Tierreich"), occurring right from arctic America (Ohlin 1895, Sars 2nd "Fram" Exped., Ortmann 1901) to Siberia.

Rhachotropis fragilis has the same distribution but is not known from arctic America.

Melita Goësii is known from arctic America, W. Greenland (Nivak), Spitzbergen 19—75 m. and Jugor skar (Stebbing "Tierreich").

Gammaracanthus loricatus is known from arctic America, W. and E. Greenland, Spitzbergen, Franz Josephs Land, Nova Zembla, Siberia 79 m. This species is interesting from the fact, that it has

left behind a slightly altered form, *G. relictus* G. O. Sars *(G. loricatus* Lovén) as a relict in lakes in Norway (Mjøsen), Sweden (Wenner, Wetter, Stora Lee), Finland and Russia (Ladoga, Onega) (Sars, "Account" vol 1, p. 496).

Amathilla pinguis has the following distribution according to Stebbing ("Tierreich"): Greenland, depth 6—56 m., Spitzbergen 4—22 m., circumpolar, reaching lat. 82°24′ N. — Further, it is found at arctic America (Miers, Ohlin 1895, Ortman 1901, Sars 2nd "Fram" Exped.). At W. Greenland it is widely distributed at any rate down to 90 fm. (Upernivik, H. J. Hansen 1887), possibly much deeper (Lille Karajakfjord, Vanhöffen). Scott (1899) gives it from Franz Josephs Land and Sars (Crust. in Nansen, "Norweg. North-Polar Exped.", vol 1, 1900) from 84° N., 134° E.

Unciola leucopis has been taken at W. Greenland from 65°11′ N. to Olriks Bay, N. of Cape York (H. J. Hansen 1887, Ortmann 1901); E. Greenland 72°27′ N., 19°56′ W., ca. 100 fm. (H. J. Hansen 1895), N. Shannon 30 fm. and Germania Havn (ca. 75½° N.) (Buchholz); further, Spitzbergen (Goës), Varanger Fjord 90—120 fm. (Sars "Account"), Barents Sea (Hoek), Kara Sea (H. J. Hansen, "Dijmphna") and Siberia (Stuxberg "Vega"). Whether all these localities really refer to this species and not to *U. irrorata* Say, with which it has often been confused earlier, cannot be seen with certainty from the literature; but there can be no doubt, that they are at least in the main correct, as Sars ("Account") gives most of the localities just for this species, whilst remarking upon the confusion. Stebbing ("Tierreich" p. 678) gives the distribution as follows "Arctic ocean (widely distributed, depth to 300 m.; Varanger Fjord (Norway), depth 170—226 m.)".

Glyptonotus Sabini has been taken several places at Alaska (*teste* H. Richardson 1905), arctic America (Sars, 2nd "Fram" Exped.) and at W. Greenland (Julianehaab ca. 61° N., Ivsugiksok ca. 76° N., 5—12 fm., H. J. Hansen 1887); Barents Sea 77°14′ N., 38°26′ E., 76 fm. (Stebbing, Ann. Mag. Nat. Hist. ser 7, vol 5, 1900, p. 14) and N. of Siberia, widely distributed both W. of Cape Tjeljuskin and in the eastern part of the Siberian Polar Sea (Stuxberg, Bihang .... vol 5, 1880). Further, H. Richardson (1905, p. 350) gives quite a number of localities within the arctic region.

Dajus Mysidis is widely distributed within the arctic region.

3E. Boreoarctic littoral species, which range from America (or Greenland) to Spitzbergen, but are not found N. of Siberia and have their southern boundary in Europe S. of Finmarken (a few also live in deeper water).

Hyas araneus.	Lithodes Maja.
— coarctatus.	Eupagurus pubescens.

Sabinea Sarsii.
Spirontocaris Gaimardii.
— spinus.
— turgida.
Pandalus Montagui.
? Hyale Nilssonii.
Ambasia Danielssenii.
Socarnes Vahlii.
Hippomedon denticulatus.
Anonyx gulosus.
Tryphosa nanoides.
Opisa Eschrichtii.
Argissa typica.
Phoxocephalus Holboellii.
Paraphoxus oculatus.
Andaniella pectinata.
Gitanopsis bispinosus.
Amphilochus manudens.
Metopa pollexiana.
— longimana.
— neglecta.
— longicornis.
— Bruzelii.
? — nasuta.
Syrrhoë crenulata.
Tiron acanthurus.
Monoculodes Kroeyeri.
— latimanus.
— tuberculatus.
Monoculopsis longicornis
Halimedon Mülleri.
— brevicalcar.
— megalops.
Paramphithoë pulchella.
— bicuspis.
— assimilis.
Parapleustes glaber.
? — latipes.
? Epimeria loricata.
Acanthonotosoma serratum.
Odius carinatus.
Apherusa Jurinei.
— bispinosa.
? Amphitopsis longicaudata.
Calliopius læviusculus.
— Rathkei.
Leucothoe spinicarpa.
Rhachotropis inflata.
Lilljeborgia fissicornis.
Pardalisca abyssi.
— cuspidata.
— tenuipes.
Melita dentata.
Moera Loveni.
Amathilla homari.
Ampelisca macrocephala.
Haploops setosa.
Photis Reinhardii.
— tenuicornis.
Protomedeia fasciata.
Gammaropsis melanops.
Pleonexes gammaroides.
Unciola planipes.
Dulichia porrecta.
— curticauda.
Paradulichia typica.
Æginella spinosissima.
Cercops Holboelli.
Caprella septentrionalis.
? Calathura brachiata.
Idothea metallica.
Edotia nodulosa.
Janira maculosa.
Jæra marina.
Munna Fabricii.
— Kroeyeri.
Phryxus abdominalis.
Bopyroides hippolytes.
Heterotanais limicola.
Pseudotanais forcipatus.
Leptognathia longiremis.
Lamprops fuscata.
Leucon nasicus.
— nasicoides.
Eudorella emarginata.
Eudorellopsis deformis.

Campylaspis rubicunda.
Pycnogonum littorale.
Phoxichilidium femoratum.
Pseudopallene circularis.
Nymphon grossipes + N. mixtum.
Nymphon longitarse + N. micro-rhynchum.
— gracilipes + N. Stroemii.
Chætonymphon hirtipes.
— macronyx.

As will be seen, the 6 *Nymphon*-species are thrown together in pairs, as this is frequently done in the literature, so that it cannot be seen to which of the two species the localities mentioned belong.

Hyas araneus is distributed from arctic America and Greenland eastwards to Nova Zembla, but from here and almost to Bering Strait is absent. The southern boundary is from Cape Cod — Channel — N. France. It is found at 0—170 fm., mostly 0—40 fm.

Hyas coarctatus is found from W. Greenland (but not E. Greenland) to the entrance of the White Sea; the southern boundary is Cape Cod — Channel. In the Pacific it occurs from Bering Strait to Korea, perhaps to Amoy ($24^{1}/_{2}$° N.). The distribution is thus essentially boreal; 10—100 fm.; rarely 100—200 fm., perhaps 906 fm.

Lithodes Maja has the same distribution but is likewise found at E. Greenland though not in the Pacific. It lives usually at 40—100 m., greatest depth 291 fm.

Eupagurus pubescens is found at Greenland (rarely at E. Greenland), Spitzbergen, Bear Island and extends to the Kara Sea, which however it does not enter. The southern boundary is at 37°8′ N. on the American side, in Europe on the S. W. of Ireland. It lives mostly at 40—100 m., seldom 640 fm. The temperature (according to the "Ingolf") is 0.8°—8.4° C. It is largest in the north, but is not distinctly arctic.

Sabinea Sarsii is found at W. Greenland: 65°35′ N., 54°50′ W., 80 fm., and 66°32′ N., 55°34′ W., 100 fm. (H. J. Hansen 1887), and 66°35′ N., 55°54′ W., 88 fm., 1.6° C. ("Ingolf"). It is not found at E. Greenland, but occurs at E. America (Gulf of Maine and S. of Halifax), Iceland, the Færoes and in the Skager Rak. Towards N. E. it is found at E. Finmarken and reaches to the entrance of the White Sea. It may go down to 388 fm. and has its widest distribution at places which are not distinctly arctic; thus not found, for example, at E. Greenland.

Spirontocaris Gaimardii goes from arctic America (Sars 2nd "Fram" Exped.) over W. and E. Greenland to the Kara Sea. The southern boundary is Cape Cod — W. Scotland — Firth of Forth — Kiel Bay. Further, it occurs N. of Alaska and extends through the Bering Strait to 57° N. on the west coast of America.

Spirontocaris spinus is essentially arctic. It is found at W. and E. Greenland, Spitzbergen, in the Barents Sea and in the White Sea.

On the American side the southern boundary lies at Cape Cod, on the European in the Irish Sea, W. Scotland ($56^{1}/_{2}$° N.), Bohuslän and Kattegat.

Spirontocaris turgida is found at arctic America (Sars 2nd "Fram" Exped.), W. and E. Greenland, Spitzbergen, Franz Josephs Land and in the Kara Sea, but not at Iceland and the Færoes. At America the southern boundary lies a little S. of Cape Cod, in Europe it is found at N. Norway and Bohuslän. It occurs N. and S. of Bering Strait, but hardly N. of America.

Pandalus Montagui has a very interesting distribution. It is found at W. Greenland S. of 69°14′ N., but not at E. Greenland or Jan Mayen; on the other hand, it occurs at Iceland, the Færoes, British Isles and the whole of Norway. At E. America the southern boundary is at Cape Cop, in Europe in Kiel Bay and the Channel Islands. It is found at W. America N. or 39° N. It often occurs in shallow water of a few fathoms depth.

Hyale Nilssonii (= *Orchestia nidrosiensis* Kr.) is mentioned by H. J. Hansen (1887, p. 61) with much doubt as belonging to Greenland. As its European distribution however coincides with that of many certain Greenland species, it is not improbable, that it may really be found in Greenland. Its distribution elsewhere is the whole of Norway, Bohuslän, Denmark, British Isles, France, Azores, Adriatic.

Ambasia Danielssenii is found at E. Greenland 72°35′ N., 19°33′ W., 140 fm. (H. J. Hansen 1895) and the whole of Norway right to Finmarken, 40—100 fm. (Sars, "Account").

Socarnes Vahlii seems to be common at W. Greenland; it has been taken at E. Greenland by the Danmark Exped. Elsewhere it is known from Iceland, Spitzbergen, Nova Zembla, Murman Coast, White Sea, Kara Sea and Norway N. of Haugesund.

Hippomedon denticulatus is known from W. Greenland at Godthaab (H. J. Hansen 1887). Further, from the coasts of the Northern Atlantic, North Sea, Skager Rak, Kattegat (Bohuslän, Denmark), England, France, Mediterranean (Naples), 6—20 seldom 60—100 fm.

Anonyx gulosus (= *Hoplonyx cicada* Fabr.) is widely distributed at W. Greenland (H. J. Hansen 1887). At E. Greenland it has been taken in Hekla Havn (70°27′ N.) and at 72°53′ N., 20°36′ W., 96 fm. (H. J. Hansen 1895). Further, at Iceland, Spitzbergen, Norwegian Sea to 649 fm., Barents Sea, Matotschkin Skar, Kara Sea, S. and W. Norway, Bohuslän, northern part of the British Isles, France; Fayal (Azores) and Mediterranean (Chevreux, "Hirondelle" 1900).

Tryphosa nanoides is found at W. Greenland, Jan Mayen, about

the whole of Norway 50—100 fm., Bohuslän, Denmark, Shetland (Sars, "Account"; Stebbing, "Tierreich").

Opisa Eschrichtii is found at W. Greenland, Iceland, Finmarken 100 fm., Skager Rak and Korea 66 m.

Argissa typica is found at Greenland (with out locality), the whole of Norway, Kattegat, British Isles, S. to Bretagne; 38—188 m.

Phoxocephalus Holboellii is found from Greenland and N. E. America to Spitzbergen and France; 20—50 fm.

Paraphoxus oculatus is found W. Greenland: 71°10′ N., 58°56′ W., 200 fm. (H. J. Hansen 1887). E. Greenland ca. 70½° N., 5—6 and 470 fm. (H. J. Hansen 1895); further at Jan Mayen, the whole of Norway 20—100 fm., and France.

Andaniella pectinata is found at Egedesminde, W. Greenland (H. J. Hansen 1887); further at Spitzbergen and N. Norway N. of Trondhjem, 20—60 fm.

Gitanopsis bispinosus: W. Greenland. 66°30′ N., 54°50′ W., 40 fm. (H. J. Hansen 1887). Norway from the Lofotens to the Christiania Fjord, 50—100 fm.; Great Britain, France.

Amphilochus manudens is found at W. Greenland: Godthaab 40—60 fm., and 66°30′ N., 54°50′ W., 40 fm. (H. J. Hansen 1887) and arctic America (Sars, 2nd "Fram" Exped.). Further the whole of Norway 40—100 fm., Kattegat, British Isles, France.

Metopa pollexiana is found at W. Greenland: Godthaabsfjord, 156 fm. ("Tjalfe") and 67°59′ N., 56°33′ W., 98 fm. (H. J. Hansen 1887); further it is known from the Murman coast, Norway (Trondhjem, Tromsö), Shetland, British Isles.

Metopa longimana is known from W. Greenland and Norway (Haugesund, Christiania Fjord).

Metopa neglecta has the same distribution and is further known from Franz Josephs Land (Scott 1899).

Metopa longicornis is known from W. Greenland, W. Norway and the Polar Ocean (Sars in Nansen "Norweg. North-Polar Exped.").

Metopa Bruzelii is found at arctic America (Sars, 2nd "Fram" Exped.). At W. Greenland it has been found from ca. 64° N. to ca. 72° N. (H. J. Hansen, 1887) and at E. Greenland in Hekla Havn (70°27′ N., H. J. Hansen 1895). Further, at Spitzbergen, Hammerfest and Bratholm (W. Norway) (Sars, "Account").

Metopa nasuta is noted by H. J. Hansen (1887) with some doubt from W. Greenland 66°30′ N., 54°50′ W., 40 fm. It has also been found at W. Norway (Kopervik, Hardanger Fjord and Christianssund) and in the Firth of Clyde, Firth of Forth and Moray Firth.

Syrrhoe crenulata is known from W. Greenland: 7 places from 62°58′ N. to ca. 70° N., 5—ca. 70 fm. (H. J. Hansen 1887 and "Tjalfe").

From E. Greenland it is known from Hekla Havn (70°27′ N.) 5—6 fm. (H. J. Hansen 1895), Sabine Island (ca. 74½° N.) 5—10 fm. (Buchholz) and from ca. 77° N., 5—10 fm. (Danmark Exped.). Further known from Franz Josephs Land (Scott 1899), Spitzbergen (Goës) and the whole of Norway (20) 80—100 fm. (Sars, "Account").

Tiron acanthurus has been found at 8 places in W. Greenland from ca. 64° N. to ca. 72½° N., 10—80 fm. (H. J. Hansen 1887); further the whole of Norway 20—60 fm., British Isles and Kattegat.

Monoculodes Kroeyeri has been taken at 4 places at W. Greenland in the same region as the previous species, but at much less depths (6—25 fm.) (H. J. Hansen 1887). Outside Greenland it has only been taken at Haugesund (W. Norway) (Sars, Account").

Monoculodes latimanus is very common at W. Greenland from ca. 62° N. to ca. 71° N., 2—30 (70) fm. (H. J. Hansen 1887 and Vanhöffen). From E. Greenland it is known from Hekla Havn (70°27′ N.) 5—6 fm. (H. J. Hansen 1895) and ca. 77° N., 0—5 fm. (Danmark Exped.). Further, it is found at Spitzbergen, Franz Josephs Land (Scott 1899) and Norway N. of Lofoten, 10—50 fm. (Sars, "Account").

Monoculodes tuberculatus is known from W. Greenland only from Kekertak (ca. 70° N.), 60—70 fm. (H. J. Hansen 1887). At E. Greenland it has been taken in Hekla Havn (70°27′ N.) 5—12 fm. (H. J. Hansen 1895) and by the Danmark Exped. Further at Spitzbergen, almost the whole of Norway 50—100 fm. and in the Firth of Clyde.

Monoculopsis longicornis is only known from 2 places in W. Greenland, namely Godthaabs Havn (ca. 64° N.) 2—3 fm. and 68°09′ N., 56°32′ W., 48 fm. (H. J. Hansen 1887). From E. Greenland it is not known; on the other hand, it has been taken at Jan Mayen, Franz Josephs Land (Scott 1889) and at Norway in 10—20 fm. (Sars, "Account").

Halimedon Mülleri at W. Greenland has only been taken at 68° 24′ N., 55°39′ W., 215 fm. and at Godhavn (ca. 69° N.), 25—35 fm. (H. J. Hansen 1887). Further, it is known from Norway, Kattegat, British Isles and France, 47—100 fm.

Halimedon brevicalcar at Greenland has only been taken at the central part of the west coast: Holstenborg (ca. 67° N.) 1 fm., Ikamiut (ca. 68½° N.) 15—20 fm. and Christianshaab (ca. 68½° N.) 15—30 fm. (H. J. Hansen 1887). From E. Greenland it is not yet known; on the other hand, it has been taken at Iceland, Spitzbergen, Norway N. of Lofoten 30—30 fm. and Bohuslän.

Halimedon megalops has been taken at a large number of places at W. Greenland from Godthaab (ca. 64° N.) to Lille Karajakfjord at Umanak (ca. 71° N.), 4—70 fm., perhaps much deeper (H. J. Hansen

1887, Vanhöffen). Outside Greenland it is known from Norway N. of Trondhjem 20—30 fm. (Sars "Account").

Paramphithoe pulchella is known from W. Greenland only from 63°48′ N., 52°23′ W., 194 m. ("Tjalfe") and 71°10′ N., 58°56′ W., 200 fm. (H. J. Hansen 1887). Further, it is noted from Iceland, Spitzbergen, Franz Josephs Land (Scott 1899), W. and N. Norway 80—150 fm. and Bohuslän.

Paramphithoe bicuspis belongs among the commonest Amphipods at W. Greenland and goes right up into Smith Sound (H. J. Hansen 1887, Ohlin 1895, Ortmann 1901, "Tjalfe"). On the other hand, it is not known as yet from E. Greenland, but has been found at Iceland, Spitzbergen, Franz Josephs Land (Scott 1899), Norway N. of Christianssund, Bohuslän, Kattegat, France, British Isles and Labrador.

Paramphithoe assimilis is only known from W. Greenland, locality stated, from Godthaab (ca. 64° N.) and Egedesminde (ca. 68½° N.) (H. J. Hansen 1887). Elsewhere it has only been taken at W. Norway (Sars "Account").

Parapleustes glaber ranges at W. Greenland from ca. 64° N. to ca. 69° N. (H. J. Hansen 1887); from E. Greenland it is only known from Hekla Havn (70°27′ N.) (H. J. Hansen 1895). Outside Greenland it is known from Iceland, Spitzbergen, Franz Josephs Land (Scott 1899), whole of Norway, Murman Coast, Kattegat.

Parapleustes latipes need only be mentioned here, as it probably belongs to Group 1 C., under which its distribution has been shown.

Epimeria loricata is noted here with some doubt; possibly with just as much right it might be placed under Group 1 C. or 2. At W. Greenland it is only known from 4 places, namely 63°24′ N., 53° 10′ W., 892 m. ("Tjalfe"), 65°35′ N., 54°50′ W., 80 fm. (H. J. Hansen 1887), 66°41′ N., 56°17′ W., 150 m. and 66°42′ N., 56°12′ W., 130 fm. ("Tjalfe"); it is also known from eastern N. America, N., W. and S. Spitzbergen 225—475 m. and Finmarken 100—150 fm. Further, it has been taken in the Norwegian Channel ca. 58°—59° N., 292 m. + 5.83° C. along with *Aceros phyllonyx* and *Acanthozone cuspidata* among others. To judge from the available material, it cannot be considered excluded, that it may be an Atlantic deep-water form whose presence at Spitzbergen is due to the Gulf Stream; it is to be hoped, that future investigations will show, where this species should rightly be placed in geographical regards.

Acanthonotosoma serratum is common on the west coast of Greenland from ca. 63° N. to ca. 72° N. (H. J. Hansen 1887, "Tjalfe"). At E. Greenland it has only been found at N. Shannon (ca. 76° N.) (Buchholz). Outside Greenland it has been taken at Iceland, Spitzbergen,

Norway N. of Haugesund 10—50 fm., Bohuslän, Barents Sea, Murman Coast, Kara Sea, Labrador and eastern N. America.

Odius carinatus is known from arctic N. America (Sars 2nd "Fram" Exped.). From W. Greenland it is only known from 3 certain localities from ca. 64° N. to ca. 68$^1/_2$° N. (H. J. Hansen 1887), but it is also known from Spitzbergen, whole of Norway down to 113 m. and Shetland.

Apherusa Jurinei is not known from W. Greenland, but at E. Greenland it has been taken in Hekla Havn (70°27′ N., H. J. Hansen 1895) and by the Danmark Exped. Further, it is known from Norway (Christianssund, Haugesund, Jæderen), Kattegat, England, France and Mediterranean.

Apherusa bispinosa is new for Greenland, taken by the Danmark Exped. It is also known from shallow water at S. and W. Norway, Bohuslän, Kattegat, British Isles, France and Algiers.

Amphitopsis longicaudata in Greenland has only been taken at Disko Island, 128 fm. ("Tjalfe"). Outside Greenland it is only known from Norway, namely, S. of Bodø 50—150 fm. (Sars "Account"). It can scarcely be considered as excluded, that it may be a eurytherm species which belongs to Group 1 C.

Calliopius læviusculus is found at W. Greenland, Labrador, Spitzbergen, Franz Josephs Land (Scott 1899), Norway S. of Karmøen, British Isles and Northern Pacific.

Calliopius Rathkei has been taken by the 2nd "Fram" Exped. at Disko Island, W. Greenland (Sars). Further, from the whole S. and W. Norway, Bohuslän, Kattegat, British Isles, Holland and France.

Leucothoe spinicarpa has almost the same distribution, but in the south goes to the Mediterranean and Azores (Chevreux, "Hirondelle" 1900) and is also found in Puget Sound in the Northern Pacific (Walker, Transact. Liverpool Biol. Soc. 1898, vol 12, p. 281).

Rhachotropis inflata has been taken in W. Greenland at Nivak (ca. 68$^1/_2$° N.) 5—15 fm. (H. J. Hansen 1887) and at E. Greenland by the Danmark Exped. Outside Greenland it has been taken round the whole of Norway (10) 30—50 fm. and in the Kara Sea.

Lilljeborgia fissicornis is known from W. Greenland only from 67°59′ N., 56°33′ W., 98 fm. (H. J. Hansen 1887). Further, 70°32′ N., 8°10′ W., 470 fm. (S. of Jan Mayen) (H. J. Hansen 1895), Spitzbergen, Norway N. of Trondhjem 50—200 fm. (Sars "Account") and in the Norwegian Channel 58°—59° N., 292 m., 5.83 C. (Appellöf, Norsk Havfiske 1905, p. 73, footnote); Bohuslän, Gulf of Gascony 180 m. and the Azores 1372 m. (Chevreux "Hirondelle" 1900).

Pardalisca abyssi Boeck (= *P. cuspidata* Buchh., non Kr.) and *P. cuspidata* Kr. non Buchh. These are considered by Sars ("Account",

vol 1, pp. 406 and 403) to be two different species, whilst Stebbing ("Tierreich", p. 222) makes them synonyms. Sars (l. c.) gives the distribution as follows: *P. abyssi:* "Boeck found this species at Haugesund and Hvitingsø. I have myself met with it in several places off the west coast of Norway, and especially very abundantly in the inner part of the Trondhjemsfjord at Vennæs, where it occurred in a depth of 100 to 150 fathoms. It extends northwards to the Lofoten Isles, but has not yet been found off the Finmarken coast. – Distribution: West of Spitzbergen (St. 359 of the Norwegian North-Atl. Exped.), South of Halifax, Nova Scotia (Stebbing)". — The distribution of *P. cuspidata* Kr. is given by Sars (l. c.) as follows: "Off the coast of Finmark, this form is not rarely met with, in moderate depths ranging from 10—30 fathoms. I have for instance collected it rather plentifully in the Kronangenfjord, and also in the neighbourhood of Tromsø. It occurs also occasionally off the west coast of Norway, as for instance at Christianssund; and extends, according to Bruzelius, as far south as Bergen. — Distribution: Greenland (Krøyer), Spitzbergen (Goës), Matotschin skar (Stuxberg), Bohuslän (Bruzelius)". — From W. Greenland we only know *P. cusdata* Kr., which has been taken at 62°58′ N., 50°52′ W., 25 fm. ("Tjalfe"), Godthaab (ca. 64° N.) (Krøyer), Egedesminde (ca. 68$^1/_2$° N.) 30—40 fm. (H. J. Hansen 1887) and Lille Karajakfjord (ca. 71° N.) (Vanhöffen; as this author does not have *P. cuspidata* Buchh. in his 1897 list, it is not excluded, that the locality mentioned by him does not refer to this species). From E. Greenland, on the other hand, both species are known; *P. cuspidata* Kr. has been taken by the Danmark Exped., *P. abyssi* at N. Shannon (ca. 75$^1/_2$° N.) 35 fm. (Buchholz). *P. cusp.* Kr. has also been taken at Jan Mayen (Koelbel) and at Franz Josephs Land (Scott 1899).

Pardalisca tenuipes has been taken as new for Greenland by the Danmark Exped. Elsewhere it has been found only "sparingly in a few places off the west coast of Norway, as also in the Trondhjemsfjord, and only in depths ranging from 50—100 fathoms (Sars "Account", vol 1, p. 405).

Moera Lovéni is known from W. Greenland only from Disko Island, 301 m. (H. J. Hansen 1887); elsewhere, from Spitzbergen, N. Norway, Bohuslän, Kattegat, Scotland.

Melita dentata is known from N. W. Greenland to Jugor Skar, but is not found N. of Siberia (Stuxberg). It is also found at Newfoundland (Chevreux, "Hirondelle" 1900), Norway N. of Karmøen, Bohuslän, Kattegat and the British Isles. Further, it has been taken in Puget Sound in the Northern Pacific (Walker, Transact. Liverpool Biol. Soc. vol 12, 1898, p. 282).

Amathilla homari is a widely distributed species. It is found at arctic America (Ohlin 1895, Sars 2nd "Fram" Exped.). At W. Greenland it is known almost from the south point right up into Smith Sound (H. J. Hansen 1887, Ohlin 1895), and from E. Greenland at Sabine Island (ca. 74½° N.) 10—110 fm. and from Germania Havn (Buchholz); it has also been taken by the Danmark Exped. Further, it is known from Jan Mayen (Koelbel), Spitzbergen, Franz Josephs Land (Scott 1899), Murman Coast, whole of Norway, Kattegat, England, France. The depth is 0—206 m. (Stebbing "Tierreich"), usually but a few m.

Ampelisca macrocephala is known from Labrador and eastern N. America. At W. Greenland it has been taken at a number of places from ca. 64° N. to ca. 70° N., and at E. Greenland it is known from 72°53′ N., 20°36′ W., 96 fm. (H. J. Hansen 1895 and Danmark Exped.). Further, it has been taken at Iceland, Spitzbergen, Barents Sea, Kara Sea, Norway, Bohuslän, Kattegat.

Haploops setosa is known from W. Greenland only from 65°11′ N., 53°33′ W., 48 and 50 fm., and 69°16′ N., 58°08′ W., 183 fm. (H. J. Hansen 1887), also probably 66°22′ N., 57°16′ W., 686 m. (a somewhat defective specimen, "Tjalfe"). It is not known from E. Greenland, but has been taken at Iceland, Spitzbergen, Barents Sea, Bear Island, Kara Sea, Norway S. of Lofoten 100—300 fm. and British Isles.

Photis Reinhardii is known from W. Greenland only from two certain localities, namely, Godthaab (ca. 64° N.) 6—10 fm. and Holstensborg Havn (ca. 67° N.) 7—35 fm. (H. J. Hansen 1887), but it has also been taken at Iceland, Norway N. of Jæderen 20—50 fm., Kattegat and British Isles.

Photis tenuïcornis has almost the same distribution; but it is not known from Iceland; on the other hand, it occurs at Franz Josephs Land (Scott 1899).

Protomedeia fasciata is known from arctic America (Sars 2nd "Fram" Exped.). At W. Greenland it is very common along the coast from the south point to Disko. On the east coast it has not been taken, but it is known from Iceland, Spitzbergen, W. Norway 6—30 fm. (but not S. Norway), Bohuslän, Kattegat and Scotland.

Gammaropsis melanops occurs at W. Greenland at a number of localities between 63½° N. and ca. 69° N.; it is also known from Norway 20—50 fm. and Kattegat.

Pleonexes gammaroides is known from W. Greenland only from Sukkertoppen (ca. 66° N.), but it is fairly widely distributed outside Greenland: W. Norway, British Isles, Azores and Mediterranean (Chevreux "Hirondelle" 1900).

Unciola planipes at W. Greenland is only known, like the pre-

vious species, from a single locality (68°09′ N., 56°32′ W., 48 fm.), but in Europe it does not go so far to the south, being only known from Norway 50—300 fm., Kattegat, British Isles and Gulf of Gascony 180 m. (Chevreux, "Hirondelle" 1900).

Dulichia porrecta in addition to a few places at W. Greenland (H. J. Hansen 1887) has been taken at Norway S. of Lofoten 10—50 fm., Kattegat, Shetland and Scotland.

Dulichia curticauda has been taken at 4 places at W. Greenland from ca. 66° N. to ca. 71° N. (H. J. Hansen 1887, Vanhöffen) and is also known from Spitzbergen and Norway.

Paradulichia typica has been taken at W. Greenland only in Olriks Bay N. of Cape York, 15—20 fm. (Ortmann 1901) and at Norway in Hardanger Fjord 56 m. and at Aalesund 94—188 m. (Sars "Account").

Cercops Holboellii has been taken at "southern Greenland", locality not stated, 45—60 fm. (Krøyer 1843) and also at Cape Roper in Baffin Land 69°45′ N., 67°20′ W., 60 fm. and in Tsugar Strait (Japan 41° N.) 30 fm. (P. Mayer, Siboga Caprell., pp. 17 and 143).

Aeginella spinosissima is widely distributed at arctic America (Miers, Ives, Ohlin 1895, Ortmann 1901, Sars 2nd "Fram" Exped.) and W. Greenland (H. J. Hansen 1887, Ohlin 1895, Ortmann 1901). From E. Greenland it is known from a number of places: Scoresby Sound 5—25 fm., 72°26′ N., 19°35′ W., 105 fm. and 72°53′ N., 20°36′ W., 96 fm. (H. J. Hansen 1895) no locality stated (Buchholz) and from the Danmark Exped., as also from Jan Mayen (Koelbel). On the American side of the Atlantic it goes southwards to 36°38½′ N., on the European side to the North Sea coast of Denmark (P. Mayer, Siboga Caprell.). It has been found, further, E. of Iceland and S. of Spitzbergen (Sars, Norwegian North-Atlantic Exped.), Franz Josephs Land (Scott 1899) and in the Kara Sea (H. J. Hansen "Dijmphna").

Caprella septentrionalis has been found at a very large number of places at arctic America and W. Greenland (H. J. Hansen 1887, Ohlin 1895, Vanhöffen 1897, Ortmann 1901, Sars 2nd "Fram" Exped.), but curiously enough not at E. Greenland, though it is known from Jan Mayen (Koelbel). Further, it has been taken at Spitzbergen, Franz Josephs Land (Scott 1899), coast of Norway from Stavanger to Finmarken, Bohuslän, Kattegat and lastly in Tsugar Strait (Japan 41° N., P. Mayer, Siboga Caprell. p. 143).

Calathura brachiata is known from W. Greenland from a number of places from 66°22′ N. to 72°20′ N., 122 fm. — 686 m. (H. J. Hansen 1887, "Tjalfe"). Further, from E. Greenland 69°25′ N., 20°01′ W., 167 fm., Scoresby Sound 5—25 fm. (H. J. Hansen 1895), 71°33′ N., 21° 30′ W. (1 km. from Murray's Island) 200 m., 72°28′ N., 21°48′ W.,

180 m., 73°20′ N., 21°20′ W., 70 m. and 74°52′ N., 17°16′ W., 350 m. (Ohlin 1901), as also Jan Mayen (Ohlin 1901), Iceland, Spitzbergen, Barents Sea, Kara Sea, Varanger Fjord, Scotland, Shetland (61°22′ N., 1°25′ W., 496 m., Zirwas 1910), Ireland, Bay of Biscay and eastern N. America. The depth varies from 10 to 1360 fm. So far as I know, this species is the only deep-water bottom-form, which seems to be equally distributed in the arctic and boreal regions, comp. *Janira maculosa.*

Idothea metallica has a very wide distribution. At W. Greenland it has been found at 64°46′ N., 53°35′ W. (H. J. Hansen 1887), at Iceland and S. of Cape Sable (south point of Nova Scotia). Further, between the Azores and Newfoundland 47° N., 37′ W. (H. J. Hansen 1887, p. 188), S. W. Ireland and widely distributed in the Mediterranean (Tattersall 1905), Monte Video, between Patagonia and Magellan Straits, N. S. Wales and Borneo. Lastly, it has been taken at a number of localities in Japan (H. Richardson, Proc. U. S. A. Nat. Mus., vol 37, 1909, pp. 107—08). It seems thus to be practically cosmopolitan.

Edotia nodulosa is known from certain localities at W. Greenland only from 66°46′ N. and Godhavn (ca. 69° N.). Further, it has been taken at eastern N. America, W. Spitzbergen and in the Kara Sea, as also in the northern part of the Pacific (Harger).

Janira maculosa has only been taken at 2 places at W. Greenland, namely, 66°32′ N., 55°34′ W., 100 fm., and 72°32′ N., 58°51′ W., 116 fm. (H. J. Hansen 1887) and E. Greenland: 69°25′ N., 20°01′ W., 167 fm. (H. J. Hansen 1895). Further, at Iceland, Barents Sea, whole of Norway, Kattegat, Great Belt, Baltic, Holland, north coast of France, British Isles and S. W. Ireland (Tattersall 1905). The distribution of this species thus resembles somewhat that of *Calathura brachiata,* but has only 3 arctic localities.

Jœra marina (= *J. albifrons*) has very much the same distribution; this may be given as follows (cf. Apstein, teste Zirwas 1910): 72°—40° N., 75° W.—55° E. Though in Greenland as elsewhere, where it occurs, it lives in quite shallow water, it has curiously enough only been taken at 4 places at W. Greenland, for which the records of the locality are certain; it may however be considered to be much more widely distributed. It has not been taken at E. Greenland; on the other hand, it is known from the Mediterranean.

Munna Fabricii also has almost the same distribution, but in W. Greenland goes right up to ca. 71° N. and has been taken in arctic America (Sars 2nd “Fram” Exped.); it is also known from Jan Mayen (Koelbel).

Munna Kroeyeri is found in the same regions, but is not known S. of the Channel Islands.

Phryxus abdominalis is distributed from Greenland eastwards as far as the Kara Sea; to the south it enters the Mediterranean (Carus, teste Zirwas 1910). In the Pacific it is found at W. America N. of California and at E. Siberia. A number of localities from Japan and Saghalien are given by H. Richardson in Proceedings U. S. Nat. Mus., vol 37, 1909, p. 121.

Bopyroides hippolytes has almost the same distribution as the preceding species, but in Europe it does not seem to go further south than to N. France.

Heterotanais limicola seems to be W. Atlantic; it is known from arctic America (Sars 2nd "Fram" Exped.), from Godthaab in W. Greenland (ca. 64° N.) 40—60 fm. (H. J. Hansen 1887) and Massachusetts Bay 48 fm. (Richardson 1905).

Pseudotanais forcipatus at W. Greenland has only been found in the Lille Karajakfjord at Umanak (Vanhöffen). Elsewhere it seems to be E. Atlantic: W. Norway, Skager Rak, Bohuslän, The Sound, Scotland.

Leptognathia longiremis Lillj. is often confused with G. O. Sars' species of the same name, for which however H. J. Hansen has proposed the name *L. Sarsii* (Revider. Fortegn. over Danmarks marine Arter af Isop., Tanaid., Cumac., Mysid. og Euphaus., Vid. Meddel. Natur. Foren., Kbhvn. 1909, p. 229). It cannot always be seen from the literature, which species is intended, but H. Richardson (1905, p. 19) gives the distribution as follows: "Kekertak, Greenland; Scotland; Norway; Iceland; Denmark; latit. 77°9′ north, long. 14°40′ east, off Ice Islands; latit. 74°35′ north. long. 18°23′ west, off Little Pendulum Island". It is also given by Tattersall (1905) from S. W. Ireland and by Zirwas (1910) from the North Sea: 54°49′ N., 5°30′ E., 42 m.

Lamprops fuscata is known from W. Greenland only from 3 places from ca. 68½ N. to ca. 69 N. (H. J. Hansen 1887), but not from E. Greenland. It has also been taken at Nova Zembla, Franz Josephs Land and Norway N. of Lofoten.

Leucon nasicus is known from W. Greenland from Nivak (ca. 68½° N.) and Prøven (ca. 72½° N.), at respectively 120 fm. and 2—300 fm. (H. J. Hansen 1887) and from E. Greenland from Hekla Havn (70°27′ N.) (H. J. Hansen 1895) and Scoresby Sound 70 m. (Ohlin 1901). Outside Greenland it has been taken in the Gulf of St. Lawrence, at W. Spitzbergen, Kara Sea, Nova Zembla, mouth of the Jenissei, Finmarken, W. Norway, Denmark, North Sea and lastly at one locality which seems to have been overlooked by other authors, namely, the Minch, Scotland (Norman, Ann. Mag. Nat. Hist. ser 5, vol 3, 1879).

Leucon nasicoides at W. Greenland has been taken at Godhavn (ca. 69° N.) and Kekertak (ca. 70° N.) 40 fm. (H. J. Hansen 1887) and

at E. Greenland at Little Pendulum Island, 74°35′ N., 18°23′ W., 18—21 m. (Ohlin 1901). Further: Fundy Bay, Spitzbergen, Hammerfest, Hardanger Fjord, Kristiania Fjord, Denmark, Kullen.

Eudorella emarginata is known from 4 places at W. Greenland, from ca. 61° N. to ca. 71° N. (H. J. Hansen 1887). Its distribution outside Greenland is as follows: Gulf of St. Lawrence, Spitzbergen, Nova Zembla, Samoyede Peninsula, mouth of the Jenissei, Kara Sea, Finmarken, W. Norway, Kristiania Fjord, Denmark, North Sea, Hebrides, Irish Sea; it goes down to 410 fm. (Calman 1905).

Eudorellopsis deformis at W. Greenland is only known from Godthaab (ca. 64° N.), 12 fm. and Godhavn (ca. 69° N.) 8—10 fm. (H. J. Hansen 1887) but has also been taken at Iceland, Massachusetts Bay, Shinnecock Bay, S. and W. Norway, Denmark and North Sea as also W. Ireland: Carnlough Bay, Co. Antrim 3—5 fm. (Calman 1905).

Campylaspis rubicunda at W. Greenland is known from 3 places from 66°59′ N. to Olriks Bay N. of Cape York (H. J. Hansen 1887, Ortmann 1901); it has also been taken at Cape Anne in Casco Bay N. of Cape Cod, S. Spitzbergen, at various places along Norway and the whole of Denmark except the Baltic.

Pycnogonum littorale is found over almost the whole of the northern part of the Atlantic and in Greenland goes northwards to 66° N. At America it goes southwards to Long Island (40° N.); on the European side it is found from the west coast of France (ca. 45° N.) to the North Cape, then eastwards to the White Sea and Murman Coast. It usually lives in fairly shallow water, but is recorded from 742 m. (east coast of N. America, Wilson).

Phoxichilidium femoratum has almost the same distribution and is often met with along with the previous species.

Pseudopallene circularis to the north has almost the same distribution as the two preceding species, but in Europe seems not to go further to the south than the Sound (Kullen) and Scotland.

Nymphon grossipes + *N. mixtum* are known from arctic America and W. and E. Greenland. These species are also known from the same places as the foregoing, but in addition go right into the Kara Sea. After "Fauna Arctica" they are found in temperatures from + 20° C. to —2 C. and are thus eurythermic to a striking degree.

Nymphon longitarse + *N. microrhynchum* and *N. Stroemi* + *N. gracilipes* and *Chaetonymphon hirtipes* have almost the same distribution; they can all be found in depths greater than 100 fm.

Chaetonymphon macronyx has its southern boundary at Norway, the Færoes and Iceland and lives at a depth of 115—1321 m.

3F. Boreoarctic littoral forms, which range from America eastwards to and including Siberia, so that they are probably circumpolar, and which in Europe are found S. of Finmarken. (Some also live in deep water.)

Sabinea septemcarinata.	Atylus carinatus.
Spirontocaris polaris.	? Pontogeneia inermis.
Onisimus Edwardsii.	Halirages fulvocinctus.
— plautus.	Gammarus locusta.
Orchomene minutus.	Ampelisca Eschrichtii.
? — serratus.	Haploops tubicola.
Pontoporeia femorata.	Byblis Gaimardii.
Monoculodes borealis.	Podocerus (Ischyrocerus) anguipes.
Pleustes panoplus.	Diastylis Rathkei.
	— scorpioides.

Sabinea septemcarinata in contrast to *S. Sarsii* is essentially arctic. W. of Greenland it is found from Ivigtut (ca. 61° N.) to 81°44′ N. (Grinnell Land) and Gaasefjord (arctic America, Sars 2nd "Fram" Exped.), most often from 72° N. to 79²/₃° N. At E. Greenland it is most common between 70°27′ N. and 74°33′ N.; the Danmark Exped. has taken it 5 times. It is also known from eastern N. America N. of 42¹/₃° N., Jan Mayen, Iceland, Norway N. of Lofoten, Spitzbergen and perhaps Shetland. Eastward it enters the White Sea and the Kara Sea and has been taken N. of Siberia, but not in the Bering Strait or N. America. Sars (Crust. in Nansen, "Norweg. North-Polar Exped.", vol 1, 1900) mentions the myto-stage from 78° N., 136 E. (N. of New Siberia). It occurs on the whole in very shallow water, usually in but a few (5—10—25) fm.

Spirontocaris polaris is found at arctic America (Sars 2nd "Fram" Exped.), W. and E. Greenland, Barents Sea, Kara Sea and Siberia; the southern boundary is eastern N. America N. of 41°34¹/₂′ N., Shetland, Hebrides and Skager Rak. It is also found N. and S. of Siberia. Birula writes (1910, p. 18) regarding its circumpolarity: "Im Karischem Meere ist Hetairus polaris schon von der Dijmphna-Expedition erbeutet worden; im ostsibirischen Teile des Eismeeres wurde diese Art bisher noch nicht erwähnt; daher erweitert die Auffindung desselben im Nordenskiöld-Meere und am Meridiane der Neusibirischen Inseln durch die Russische Polar-Expedition das Verbreitungsgebiet der Art beträglich nach Osten, beinahe zur vollständigen Circumpolarität. Meines Wissens ist H. p. nur in der Tschuktschen-See noch nicht konstatiert worden; im Beaufort-Meere ist diese Art von amerikanischen Expeditionen gefunden (nach Stimpson, teste Hansen)".

Onisimus Edwardsii is very common in arctic America and W. Greenland (Miers, H. J. Hansen 1887, Ortmann 1901); at E. Greenland it has been taken by the Danmark Exped. In America S. of Greenland it does not seem to be known; on the other hand, it has been taken at Jan Mayen, Iceland, Spitzbergen, Franz Josephs Land, Murman Coast, Kara Sea and Siberia and goes along the coast of Norway to Bohuslän and the Kattegat.

Onisimus plautus has almost the same distribution but is not so common at W. Greenland, whereas at E. Greenland it has been taken at 3 places at ca. $74^1/_2$°N. (Buchholz) as well as by the Danmark Exped. Chevreux ("Hirondelle" 1900) gives it from Newfoundland.

Orchomene minutus is known from arctic America (Ohlin 1895) and is very common along W. Greenland almost from the south point right up into Smith Sound (H. J. Hansen 1887, Ohlin 1895). From E. Greenland it is given from Hekla Havn (70°27′ N., H. J. Hansen 1895). It goes along the Norwegian coast to the Skager Rak and is recorded with some doubt from the British Isles and the Mediterranean.

Orchomene serratus has been taken as new for Greenland by Duc d'Orleans 1907; it has also been taken by the Danmark Expedition. It is also known from Norse Island at Spitzbergen, Siberia and Norway 56—188 m., but it is not yet known from arctic America or W. Greenland.

Pontoporeia femorata belongs to the commonest Amphipods at W. Greenland; further, it has been taken at arctic America (Sars 2nd "Fram" Exped.) and at E. Greenland in Hekla Havn (70°27′ N., H. J. Hansen 1895) and by the Danmark Exped. To the south it goes through the Kattegat into the Baltic.

Monoculodes borealis has been taken at W. Greenland from Godthaab (ca. 64° N.) to Olriks Bay N. of Cape York (H. J. Hansen 1887, Ortmann 1901) and at E. Greenland by the Danmark Exped. At Norway it is found N. of Trondhjem; Scotland is its southernmost habitat.

Pleustes panoplus has been taken at a number of scattered stations in W. Greenland almost from the south point right up into Smith Sound (H. J. Hansen 1887, Ohlin 1895, Ortmann 1901), as well as at arctic America; at E. Greenland it has been taken at Sabine Island (Buchholz) and by the Danmark Exped. In Norway it occurs N. of Bergen.

Atylus carinatus is known from arctic America and from some scattered places along the whole west coast of Greenland (Miers, H. J. Hansen 1887, Ives 1891, Ohlin 1895, Ortmann 1901). It is mentioned from E. Greenland by Buchholz and H. J. Hansen 1895,

and has also been taken there by the Danmark Exped. At Siberia it is so common that it is a characteristic form both W. and E. of Cape Tscheljuskin (Stuxberg, Bihang .... vol 5, 1880). At Norway it is found at any rate at Tromsø, perhaps at Molde (Sars "Account").

Pontogeneia inermis is extremely common at W. Greenland (H. J. Hansen 1887, Vanhöffen, Ortmann 1901) and E. Greenland (Buchholz, H. J. Hansen 1895, Danmark Exped.). It is also found at eastern N. America and W. Norway, whilst its occurrence at Siberia is not certain.

Halirages fulvocinctus has a similar distribution at Greenland to the foregoing, but it does not seem to be so common at W. Greenland.

Gammarus locusta ranges from arctic America over Greenland eastwards to Siberia and the Polar Sea (Sars: Crust. in Nansen "Norweg. North Polar Exped.", vol 1, 1900). It is found along the whole western side of Europe and enters the Mediterranean, perhaps into the Black Sea; it has also been taken at the Canary Isles (Chevreux, "Hirondelle" 1900).

Ampelisca Eschrichtii does not seem to occur S. of the Kattegat.

Haploops tubicola goes right into the Baltic and also southwards to France.

Byblis Gaimardii ranges at least to the Kattegat, possibly into the Mediterranean.

Podocerus anguipes goes eastwards to the Kattegat.

Diastylis Rathkei is found in probably all arctic seas; it is a characteristic form both in the Kara Sea and E. of Cape Tscheljuskin (Stuxberg, Bihang .... vol 5, 1880). Southwards it goes to the Gulf of St. Lawrence, Firth of Forth and Belgium.

Diastylis scorpioides is known from arctic America (Sars 2nd "Fram" Exped.) and is common at W. Greenland from 63°35′ N. to 71°10′ N. (H. J. Hansen 1887); at E. Greenland it has been taken from Hekla Havn (70°27′ N.) to ca. 77° N. (H. J. Hansen 1895, Ohlin 1901, Danmark Exped.). It is also known from Jan Mayen, Spitzbergen, Norway N. of Lofoten, White Sea, Nova Zembla, Kara Sea, New Siberian Islands and N. of the mouth of the Jenissei. It is thus almost purely arctic.

4. Plankton.

It is not always easy to determine, especially in the case of species which live in deep water, whether they should be considered bottom-forms or as belonging to the plankton; in cases of doubt they are referred to the former group. To make the summary easier, all the Schizopods are included under the plankton, although several, e. g. *Mysis oculata*, are true littoral forms or bottom-animals.

Further, the parasites are also taken here, if their hosts belong to the open sea *(Cyamus, Ægа, Dajidae)*. There remain a couple of uncertain species, namely, the Amphipods *Apherusa glacialis* and *Eurytenes gryllus*. The former seems certainly to belong to the open sea; but as it has been at least several times met with in among the drift-ice, it is included under the littoral forms (Group 3 C., p. 586). The case is more difficult with *Eurytenes gryllus;* but, for reasons to be given later, it must be referred to the plankton.

The plankton may be divided into an essentially arctic and an essentially boreal group, but for the moment we are in great need of hydrographical material, so that future investigations will certainly make great changes in the lists below, among other things, in the direction of removing from the one list to the other; there seems to be no doubt, that there are very few, really arctic species among the plankton Malacostraca, that is, species which exclusively or mainly live in water of negative temperature. Most of the distinctly arctic forms will certainly prove to be rather bottom-animals than plankton-forms.

4 A. Plankton species which are mainly arctic.

Boreomysis nobilis.	Stilomysis grandis.
Erythrops abyssorum.	Mysis oculata.
— glacialis.	Lanceola Clausii.
Meterythrops robusta.	Euthemisto libellula.
Parerythrops spectabilis.	Cyclocaris Guilelmi.
Amblyops Crozetii.	Cyamus mysticeti.
Pseudomma frigidum.	— monodontis.
— truncatum.	— nodosus.
— Theelii.	Dajus mysidis.

Boreomysis nobilis has been found at a number of places in the Davis Strait N. of 63°24′ N., 892 m. (H. J. Hansen 1887, "Tjalfe"), but seems otherwise to belong to the cold area with the coasts.

Erythrops abyssorum ranges from W. Greenland over Norway to the Kara Sea and goes south as far as north of the Hebrides (59° 25′ N. —59°36′ N.), 1100—1060 m., 7.10°—7.22° C. (Tattersall 1911).

Erythrops glacialis is known from E. Greenland and the middle of the Norwegian west coast in the cold area.

Meterythrops robusta has been taken in the Davis Strait 68°40′ N., 53°12′ W., 410 m., 350 m. wire ("Tjalfe") and in Massachusetts Bay; elsewhere it belongs to the cold area with coasts and the Kara Sea. The record of its occurrence at W. Ireland (Holt and Tattersall) is

due to confusion with *Parerythrops obesa* (H. J. Hansen "Ingolf" 1908, p. 107).

Parerythrops spectabilis has been taken at W. Greenland in Lille Karajakfjord (ca. 71° N., Vanhöffen), otherwise only in the cold area.

Amblyops Crozetii is only known from E. Greenland 72°42′ N., 14°49′ W., 1058 fm. (Ohlin 1901).

Pseudomma frigidum has been taken at E. Greenland 74°30′ N. (Ohlin 1901: *P. roseum*, but is in reality *P. frigidum*, teste H. J. Hansen "Ingolf" 1908, p. 110). It is also known from Jan Mayen and N. W. of the Færoes, as also probably Matotschkin Skar.

Pseudomma truncatum has been taken at W. Greenland in Lille Karajakfjord (Vanhöffen) and in the Gulf of St. Lawrence; it goes eastwards to the Kara Sea and has perhaps been taken in the Bering Strait.

Pseudomma Theelii is only known from E. Greenland 74° 30′ N., 220 m. (Ohlin 1901).

Stilomysis grandis ranges from the coast of W. Greenland to the Kara Sea and has possibly been taken in the Bering Strait.

Mysis oculata is almost circumpolar arctic; it occurs in all arctic seas and enters into the northern parts of the boreoarctic region, e. g. Iceland, but is not found in the purely boreal region. It has been taken however in the Sound off Landskrona 29 m. (Lönnberg, Meddel. från Kgl. (Svenska) Landtbruksstyrelsen, Nr. 1, 1898). This isolated find in such a well-investigated water as the Sound is so remarkable, that the record seems to be due to a wrong label, and it is not possible, at any rate at present, to regard the animal as a relict on the basis of this single discovery. On the other hand, it has left a slightly transformed relict form in freshwater, *M. oculata* Fabr. var. *relicta* (Lovén) G. O. Sars, which is known from Norway (Mjösen), Sweden (the large lakes), Denmark (Furesø), Finland, Russia, Germany and the large North American lakes (Wesenberg-Lund, Kgl. danske Vid.-Selsk. Oversigt, 1902, p. 257; Samter, Königl. preuss. Akad. Wiss. Berlin 1905).

Lanceola Clausii in W. Greenland has been taken in Baffins Bay, ca. 72° N. (Bovallius 1885). Sars (Crust. in Nansen "Norweg. North-Atlantic Exped.", vol. 1, 1900) gives it from the following localities: Polar Sea: 80° N., 134° E.; 84°15′N.—84°42′ N., 96° E.—72° E.; 84°47′ N. —83°57′ N., 25° E.—11° E.

Euthemisto libellula is circumpolar and almost exclusively arctic; it composes a very essential part of the plankton of the Polar Sea. The "Tjalfe" has taken several thousand specimens at W. Greenland from 58°32′ N. to 70°42′ N.

Cyclocaris Guilelmi has been taken at 3 stations at E. Greenland

$71^{1}/_{2}°$ N.—$79^{1}/_{2}°$ N. (Duc d'Orleans 1907; l. c. p. 270 it is named *Bythocaris Guilelmi* Chevreux, but this must be a misprint for *Cyclocaris G.*, for in many other names in that paper there are misprints. It has also been taken at the Lofoten Islands (Chevreux, Bull. Soc. Zool. France, vol. 24, 1899) and by the Norwegian North-Polar-Exp. (Sars 1900).

Cyamus mysticeti lives on *Balaena mysticetus* and is said to be circumpolar arctic (Ohlin 1895) like

Cyamus monodontis on *Monodon monoceros*.

Cyamus nodosus also lives on *Monodon* and is recorded from Umanak in W. Greenland (Miers 1880).

Dajus mysidis on *Mysis oculata* has the same distribution as the host (see above), but does not seem to occur N. of Siberia.

4 B. Mainly boreal Plankton species.

Acanthephyra purpurea.
Pasiphaë tarda.
Parapasiphaë sulcatifons.
Hymenodora glacialis.
Gennadas elegans
Sergestes arcticus.
Thysanopoda acutifrons.
Meganyctiphanes norvegica.
Thysanoessa longicaudata.
— inermis.
Rhoda Raschii.
Nematoscelis megalops.
Gnathophausia zoëa.
Eucopia unguiculata.
— sculpticauda.
Hansomysis Fyllæ.
Boreomysis tridens.
— arctica.
— microps.
Longithorax fuscus.
Erythrops erythrophthalma.
Meterythrops picta.
Amblyops abbreviata.
Pseudomma roseum.
— parvum.
Mysis mixta.

Lanceola Loveni.
— serrata.
— Sayana.
Vibilia Kroeyeri.
Mimonectes Steenstrupii.
Hyperia medusarum.
— galba.
Hyperoche medusarum.
Parathemisto oblivia.
Euthemisto compressa.
— bispinosa.
Scina sp.
Metacyphocaris Helgæ.
Katius obesus.
Cyphocaris anonyx.
Eurytenes gryllus.
Paracyamus boopis.
Æga crenulata.
— psora.
— arctica.
— ventrosa.
Munnopsis typica.
Munneurycope Tjalfiensis.
Eurycope cornuta.
Holophryxus Acanthephyræ.
— Richardii.

Acanthephyra purpurea is known both from W. and E. Greenland and from N. America between 31°41′ N. and 42°2′ N., as also N. W. of the Bermudas. On the east side of the Atlantic it has been taken in the Bay of Biscay, off Portugal, in the Mediterranean and at the Cape Verde Isles.

Pasiphaë tarda has a similar distribution, but is also known from N. Europe; thus it is very common in the Skager Rak.

Parapasiphaë sulcatifrons seems to be western Atlantic; Kemp (1910) records it however from S. W. Ireland.

Hymenodora glacialis also seems to be western Atlantic, as it has been taken at E. Greenland (but not W. Greenland) and E. America; further, it has been taken W. of Spitzbergen and in the Polar Sea 80° N., 134° E. (Sars, "Norweg. North-Polar Exped.", vol. 1, 1900), and Kemp (1906) records it from S. W. Ireland. But it is also found in the Pacific: Bering Sea, Gulf of California, Gulf of Panama and at Ecquador.

Gennadas elegans and *Sergestes arcticus* have almost the same distribution as *Acanthephyra purp. Sergestes* is thus, in spite of its specific name, not arctic but boreal (it is not found for example at E. Greenland). Further, it is also known from Norway and goes southwards to Monte Video, and is found S. of Australia.

Thysanopoda acutifrons seems to be western Atlantic. The "Tjalfe" has taken it, as new for W. Greenland, at the mouth of the Davis Strait. It goes southwards to 46¼° N.

Meganyctiphanes norvegica is found within a region which is bounded by E. America N. of 40° N., S. E. Greenland, Spitzbergen and the west coasts of Europe, as well as Mediterranean at Messina, but it goes further north-east to Siberia and is said to have been taken in the Bering Sea.

Rhoda Raschii occurs from Greenland to Norway and Scotland.

Thysanoessa inermis (= *Rhoda inermis* + *Thysanoessa neglecta* see p. 556, after No. 47) is distributed over the whole North Atlantic and occurs at W. Greenland S. of Karajakfjord (ca. 71° N.); northern boundary is Franz Josephs Land, the south boundary France. Further, it has been taken in the Sea of Ochotsk.

Also *Thysanoessa longicaudata* is North Atlantic.

Nematoscelis megalops occurs in the greater part of the Atlantic, but not between 28° N. and 37° S. The "Tjalfe" has taken it at S. E. Greenland. It is also recorded from the Indian Ocean.

Gnathophausia zoëa, Eucopia unguiculata and *E. sculpticauda* go from W. and E. Greenland down into the tropical Atlantic or at least to the Azores and Canary Isles. *E. sculpticauda* does not seem however to occur at W. Greenland, but all three species are known

from the Indian Ocean and *Gnathophausia* and *E. sculpticauda* further from the Pacific. *E. unguiculata* is also found in the Western Mediterranean.

Hansenomysis Fyllae was known earlier (H. J. Hansen "Ingolf" 1908) only from Davis Strait and S. W. of the Færoes; but in 1911 Tattersall gives 6 localities for the species at S. W. Ireland, depth of bottom 550—900 fm., depth of net 0—700 fm., temp. 8.35°—16.20° C., 35.35—35.53 ‰ salinity.

The 4 species last-mentioned seem to be West-Atlantic, as they have never been found at Norway.

Boreomysis tridens is known from W. Greenland, N. Norway and W. Ireland.

Boreomysis arctica is exclusively boreal, in spite of its specific name. It ranges from W. Greenland (not known from E. Greenland) and eastern N. America to Norway; southwards it goes to Capri.

Boreomysis microps seems to be very common at W. Greenland ("Tjalfe"), where, curiously enough, the "Ingolf" has not found it; further, it is Western Atlantic: it is known from Nova Scotia to the Færoes and W. Ireland, as also from the Azores.

Longithorax fuscus, a new species from the "Ingolf" Exped., is mentioned by H. J. Hansen ("Ingolf") only from 2 localities, namely 49°27′ N., 13°33′ W., 2800 m. wire out, 2600 m., and 61°30′ N., 17°08′ W., 1800 m., wire out. Later it has been taken at 2 other localities, namely 50°59′ N., 11°52′ W., 900—1064 fm., 15.4° C. (Tattersall 1911) and 60°07′ N., 48°26′ W., 2000 m., wire out ("Tjalfe").

Erythrops erythrophthalma ranges from W. Greenland and Cape Cod to Spitzbergen, Kara Sea and the whole coast of Norway; further, it has possibly been taken in the Mediterranean.

Meterythrops picta is known from E. Greenland to the Hebrides and W. Ireland.

Amblyops abbreviata ranges from Davis Strait to Norway and W. Ireland.

Pseudomma roseum is distributed from W. Greenland to Nova Zembla and Norway; it is found perhaps also at eastern N. America. The record of its occurrence at E. Greenland (Ohlin 1901) is probably due to confusion with *P. frigidum* (see H. J. Hansen "Ingolf" 1908, p. 110).

Pseudomma parvum was only known earlier from Lille Karajakfjord in W. Greenland (ca. 71° N., Vanhöffen) but is noted by Tattersall 1911 from S. W. Ireland, 50°48′ N., 11°41′ W., 900 fm. These 2 occurrences are very interesting in zoogeographical regards, as the one belongs to the deep part of the Atlantic, the other to the deep basin N. of the ridge in the Davis Strait; but, as also already

remarked (p. 566), some of the fjords of W. Greenland, at least northwards to Karajakfjord and Umanakfjord, should be considered Atlantic in hydrographical regards. *Pandalus borealis* has a similar distribution (Group 2, p. 579).

Mysis mixta ranges from W. Greenland and Massachusetts Bay to the Murman Coast and the Danish waters.

Lanceola Loveni is known from W. Greenland, locality not stated (Bovallius 1885).

Lanceola serrata is recorded by Bovallius (1885) from the mouth of the Davis Strait. The "Tjalfe" has taken it in the Davis Strait, namely, 63°18′ N., 54°55′ W., 1300 m., 1530 m. wire out and 64°22′ N., 55°48′ W., 1040 m., 1200 m. wire out. Further, the species has been taken at Nova Scotia (Stebbing) and S. W. Ireland (Tattersall 1906).

Lanceola Sayana is the Greenland species of *Lanceola*, which has the best known distribution. The "Tjalfe" has taken a specimen in the south-eastern part of the Davis Strait (62°53′ N.), which must probably be referred to this species, and Vosseler (Plankton Exped.) records it with a ? from the Irminger Sea, 0—600 m. Further, there are the following records: N. and S. Atlantic (Bovallius), S. of Rockall (Norman), S. W. Ireland (Tattersall 1906), 42°38′ N., 21°54′ W., surf., 41°01′ N., 41°01′ W., surf., and 39°12′ N., 28°20′ W., surf., (Chevreux, "Hirondelle" 1900), and ca. 5° N., 19° W. (Guinea Current) 0—400 m. (Vosseler, Plankton Exped.).

Vibilia Kroeyeri and *Mimonectes Steenstrupii* are both recorded from W. Greenland, locality not stated (Bovallius).

Hyperia medusarum seems to be extremely common S. of the Davis Strait and in its southern part, less common further north (Miers 1880, Ohlin 1895, "Tjalfe"); it is also known from Spitzbergen, Franz Josephs Land (Scott 1899), W. Norway (Sars "Account) and S. W. Ireland (Tattersall 1906).

Hyperia galba seems to range right from Labrador (Vosseler, Plankton Exped.) and Smith Sound (Ortmann 1901) to the Kara Sea and southwards to France. Further, it has been taken at S. W. Ireland (Tattersall 1906), Azores (Chevreux, "Hirondelle" 1900) and at Puget Sound in the Northern Pacific (Calman).

Hyperoche medusarum seems to be circumpolar in the north, as it has been found from Labrador to Siberia; it is also found in Norway S. of Lofoten.

Parathemisto oblivia is probably circumpolar also, as seems to be indicated by some localities from the Polar Sea (Sars, Crust. in Nansen "Norweg. North-Polar Exped.", vol. 1, 1900). Its southernmost occurrences are from S. W. Ireland (Tattersall 1906) and Bay of Biscay (Stebbing, Transact. Linn. Soc. 1904, and Bonnier "Caudan").

Euthemisto compressa and *E. bispinosa* are placed together by some authors, e. g. H. J. Hansen (V. Grønland 1887, p. 59), whilst others, e. g. G. O. Sars ("Account") and Vosseler (Plankton-Exped.) take them for separate species; when the specimens are not very small ($<$ 1 cm.) they are not difficult to distinguish. Both species seem to be very common along the whole of the west coast of Greenland, especially in the Davis Strait. *E. compressa* is known from Greenland, Jan Mayen and W. Finmarken (Sars "Account"), S. W. Ireland (Tattersall 1906) and the Florida Current, Sargasso Sea and southern Equatorial Current (Vosseler, Plankton-Exped.). *E. bispinosa* has almost the same distribution, but is not recorded by Vosseler (l. c.) from the southern Equatorial Current.

Cyphocaris anonyx has the most interesting distribution among the plankton Amphipods. It is known from the localities mentioned below, and seems to prefer cold water: "there can be little doubt that this is a cold-water form" (Fowler, Transact. Linn. Soc. 1904, ser. 2, vol. 10, part 2, p. 47). Its occurrences are the following: 8 localities in the Davis Strait from 60°07′ N. to 64°35′ N., 500 m. wire — 2000 m. wire ("Tjalfe"); 30 miles S. E. of Cape Farvel, 300 fm. (H. J. Hansen 1887); off Finmarken 69°41′ N., 15°51′ E., 1591 m., bottom-temp. —1.2° C. (Sars, "Norweg. North-Atlantic Exped."); 11 stations at S. W. Ireland (Tattersall 1906); 52° N., 15° W., 510, 1300 and 1500 fm. (Walker, Oceana 1903); 47°38′ N., 22°13′40″ W., 710 fm., 42° (F ?) (Chevreux, "Hirondelle" 1900), Bay of Biscay, 300—400 fm. (Stebbing, Transact. Linn. Soc., 1904); 46°15′ N., 7°09′ W., 0—3000 m., depth 4000 m.; 29°16′ N., 16°11′ W., 0—3000 m., depth 3670 m., at the island Hierro (Canaries) 0—3000 m., depth 3817 m. 36°17′ N., 28°53′ W., 0—3000 m., depth 3410 m.; 36°46′ N., 26°41′ W., 0—3250 m., depth 3620 m.; 37°20′ N., 21°40′ W., 0—2000 m., depth 3800 m. (Richard, Bull. Mus. Océanogr., Monaco, No. 41, 1905); 41° N., 16° W. (H. J. Hansen, V. Grønland 1887). It is also known from the Pacific: 38°07′ S., 94°04′ W., 1500 fm., 35.3° (F.?) and 32°44′ S., 13°5′ W., 1425 fm., 37° (F.?) (Stebbing, "Challenger" 1888, p. 656; *C. micronyx* = *C. anonyx*, teste Stebbing, "Tierreich").

Metacyphocaris Helgæ has been taken at 3 stations in the southern Davis Strait ("Tjalfe") and at 5 stations at S. W. Ireland (Tattersall, 1906, p. 29).

Eurytenes gryllus seems to occur over the whole Atlantic (see below). There can be no doubt, that this species should be referred to the plankton. Sars ("Account", vol. 1, p. 87) writes: "all the specimens preserved in our (Christiania) Museum have been extracted from the stomach of large sharks (*Scymnus borealis*)". H. J. Hansen (V. Grønland 1887, p. 67) records it from stomachs of fishes and

sharks and says, "it is remarkable, that this gigantic species, which probably only occurs in deep water, has never been taken fresh in Greenland waters". Stebbing (Tierreich, p. 73) records it "from *Procellaria glacialis* L., from stomachs of sharks, and fished up from great depths". As the specimens of the Danmark Exped. come from the stomach of a *Fulmarus (Procellaria) glacialis*, and this bird likes to fly low over the surface, but does not dive (Kolthoff and Jägerskiöld, Nordens fåglar, 1898, p. 300), the specimens in question must also have been taken at the surface, so that the species in any case may rightly be called pelagic. Chevreux mentions a young specimen from very great depths "Océan Atlantique, lat. 43°04′ N., longit. 19°42′ W., nasse, 5940 mètres" (Bull. Inst. Océanogr. Monaco, No. 156, 1910, p. 4). According to Sars ("Account") and Stebbing ("Tierreich") the places where it has been found are the following: Greenland, N. E. America, Spitzbergen, Finnmarken, Bay of Biscay, Azores, tropical Atlantic (4° S., 18° W.), Cape Horn.

Katius obesus has been taken by the "Tjalfe" at 6 localities at W. Greenland (58°08′ N.—64°14′ N.). It is also recorded from S. W. Ireland: 50 miles N. by W. of Eagle Island, Co. Mayo, 1200 fm. (Tattersall 1906) and 36°17′ N., 28°53′ W. (Chevreux 1905).

Paracyamus boopis lives on *Megaptera boops*. The host belongs to the N. Atlantic: Greenland, Iceland, Finmarken, S. Europe, America.

Aega crenulata is known from W. Greenland and E. America to Norway and goes southwards to S. W. Ireland (Tattersall 1995).

Aega psora, Aega arctica and *Aega ventrosa* have the same distribution; the last species goes right into the Kara Sea.

Munnopsis typica seems to be circumpolar, being known from arctic America and W. Greenland eastward to Siberia; further, it is known from the Skager Rak and almost the whole of the rest of the Norwegian coast. Perhaps, though it is pelagic, it should be referred to Group 1 C. See also Ohlin 1901, p. 32—33.

Munneurycope Tjalfiensis has been taken in the mouth of the Davis Strait 60°07′ N., 48°26′ W., 2000 m., vire out ("Tjalfe").

Eurycope robusta is known from W. and E. Greenland, eastern N. America, Kara Sea, Norway and Skager Rak; belongs perhaps to the Group I C.

Holophryxus Acanthephyræ has been taken in the mouth of the Davis Strait by the "Tjalfe" at the same place at *Munneurycope Tjalfiensis* (see above).

Holophryxus Richardii has been taken in Davis Strait 66°21′ N., 56°30′ W., 680 m., 800 m. wire out ("Tjalfe") and 33°41′ N., 36°55′ W., 0—2500 m. (Koehler 1911).

In addition to the species mentioned in the above lists, there are still a few which do not seem to fit into a zoogeographical review, for the reason that our present knowledge of their distribution is too imperfect. These species are:

Ambasia Danielssenii.	Acanthoniscus typhlops.
Rhachotropis Helleri.	Janthe laciniata.
Rocinela maculata.	Cordylochele (Pallene) malleolata.

Ambasia Danielssenii is known from E. Greenland: 70°35′ N., 19°33′ W., 140 fm. (H. J. Hansen 1895) and from the whole of Norway, 40—100 fm., right to Finmarken (Sars "Account"). Thus it is perhaps a species belonging to Group I B (cold area of the Norwegian Sea with the Norwegian Channel), but the shallow depth at Norway is against this.

Rhachotropis Helleri is recorded by Stebbing ("Tierreich") from the Arctic Ocean, N. Atlantic, North Sea and Skager Rak 94—188 m.; but this distribution is not certain, as it has been included earlier under *R. macropus* G. O. Sars (teste Sars "Account", p. 427). Sars writes (l. c.) regarding *R. Helleri*: "I have met with this species not unfrequently in several places both off the south and west coasts of Norway in depths ranging from 50 to 100 fathoms. According to Boeck it extends northwards to the Lofoten-Isles, but it has not yet been observed off the Finnmarken coast. — About the distribution of the species, it is at present somewhat difficult to state anything with certainty, as most probably — — — *R. macropus* G. O. Sars has been generally confounded with it. To judge from its occurrence off the coast of Norway, it would seem on the whole to be a more southern form than the former".

Rocinela maculata can only with doubt be referred to the Greenland fauna, as the two specimens, which have led to the species being recorded as from Greenland, were bought from a dealer in Hamburg (Bovallius, New or imperfectly known Isopods, Bihang Kgl. Svenska Vet. Akad.s Handl., vol. 10, No. 11, 1885, p. 10) and thus perhaps bear a wrong locality; otherwise it is only known from Vladivostok (Schiödte and Meinert, Naturh. Tidsskrift 3. R., vol. 12, 1879, p. 393). But, as H. J. Hansen also remarks (V. Grønland 1887, p. 187), it is not altogether impossible, that it really occurs at Greenland, since, as shown by the above lists, we now know not a few species which occur both at Greenland and in the Pacific.

Acanthoniscus typhlops is known from W. Greenland only from S. of the ridge: 63°24′ N., 53°10′ W., 892 m. ("Tjalfe") and from the cold area W. of Lofoten: 68°21′ N., 10°40′ E., 457 fm., —0.7 C. (Norweg. North-Atlantic Exped.). The depth is thus almost the same in

both cases; but how far it is essentially arctic or essentially boreal, cannot be determined from 2 isolated occurrences.

Regarding *Janthe laciniata* the same may be said. The "Tjalfe" has taken it along with the previous species, and further at 66°45′ N., 56°30′ W., 200 fm. It was known earlier from Storeggen Bank off Molde, Nordland and Finmarken.

Cordylochele (Pallene) malleolata is recorded by Sars (Norweg. North-Atlantic Exped.) from Spitzbergen, Bear Island and Kara Sea, which would refer it almost to the cold area, to which also a couple of stations of the "Ingolf" belong; but the "Ingolf" has also taken it at W. Greenland 66°35′ N., 56°38′ W., 318 fm., 3.9 C. and 63°06 N., 56°00′ W., 1199 fm. (2237 m.), 2.4° C. and a single station belongs to the deep Atlantic (64°18′ N., 27°0′ W., 295 fm., 5.8° C.).

The above review shows, that there are several faunas at Greenland which are fairly distinct from one another. The boundaries between the groups are in most cases not difficult to define, even though we lack sufficient material for several species.

Owing to its restricted nature probably the arctic fauna may be said to be the best known. The deep-water fauna is known mainly from the Norwegian North-Atlantic Exped. and from the expedition of the Duke of Orléans; the littoral fauna has been studied by a large number of expeditions and is naturally much better known, especially at Greenland and Spitzbergen. The regions N. of Russia and Siberia are mainly known from the Danish "Dijmphna" Exped. and the Swedish "Vega" Exped. Arctic America is much less favourably placed. The only expedition which has as yet passed over the whole distance north of America is the Norwegian "Gjøa" Expedition under Captain Amundsen, but the zoological material of this expedition has not yet been worked up. We can thus say nothing with certainty regarding the circumpolarity of any single species; it is quite a different thing, to suppose, that species which occur from eastern, arctic N. America over Greenland and Spitzbergen to and including Siberia, may in all probability be circumpolar, but whether the supposition is correct, is left for the future to show.

Mention has already been made of the southern boundary for the arctic deep-water fauna. The arctic littoral fauna, on the other hand, had a different boundary, due to the currents. On the European side the boundary lies E. of Finmarken. Nevertheless, it does not seem to me to be absolutely wrong to consider Finmarken, as has been done in the preceding pages, as belonging to the arctic region, since it contains like the ridge in the Davis Strait a mixture of the arctic and the boreal faunas. On the American side the boundary

lies much farther to the south, namely about Cape Cod or for a few species a little more to the north towards Newfoundland. The zoogeographical boundary-region here is one of the places, which has the greatest economical importance in the whole world. “Chacun connaît la richesse extrême en poissons du banc de Terre-Neuve. La raison principale de cette abondance sur un point aussi restreint est liée à la rencontre de deux courants à temperatures très différentes. Un courant froid qui descend des côtes boréales de l’Amérique rejoint, dans les parages de Terre-Neuve, le courant chaud connu sous le nom de Gulf Stream, qui apporte des eaux chaudes du golfe de Mexique. Au moment où les deux “fleuves” se rencontrent, une grande partie des animaux habitués à l’eau froide boreale sont tués par l’eau chaude du Gulf Stream, et réciproquement. Il s’en suit qu’à la hauteur de Terre-Neuve il y a dans la mer une foule de cadavres d’animaux qui alimentent copieusement les poissons eurythermes de cette région; ils y viennent en foule et y pullulent”. (Joubin, Cours d’Océanographie, Bull. Mus. Monaco, No. 45, 1905, p. 13—14).

The boreoarctic littoral fauna contains a large number of species, which seem on the whole to belong to the boreal region, but to be eurytherm, so that they can also live under arctic conditions. An exception, however, is *Gammarus locusta,* which grows largest in the arctic seas. On the European side the southern boundary for most of the species is at the Channel, but a few are also found as far to the south as the Azores. On the American side the southern boundary is mostly at Cape Cod. In his work on the Crustacea collected by W. A. Herdman in Puget Sound, Pacific Coast of N. America (Transact. Liverpool Biol. Soc., vol. 12, 1898, p. 270), Walker has given a list of the Crustacea from the Atlantic with corresponding species from the Pacific, and it is a remarkable fact, apparent from the lists above, that a large number of Greenland boreoarctic littoral forms are also found in the Pacific. For the sake of comparison these species are brought together below; alongside each species is noted under which group it has been mentioned.

Hyas coarctatus (3 E).
Chionoecetes opilio (3 A).
Nectocrangon lar (3 B).
Spirontocaris Fabricii (3 A).
— macilenta (3 A).
— groenlandica (3 B).
— Gaimardii (3 E).
— turgida (3 E).
Pandalus Montagui (3 E).
Opisa Eschrichtii (3 E).
Calliopius laeviusculus (3 E).
Leucothoe spinicarpa (3 E).
Melita dentata (3 E).
Cercops Holboelli (3 E).
Caprella septentrionalis (3 E).
Idothea metallica (3 E).
Edotia nodulosa (3 E).
Phryxus abdominalis (3 E).
Bopyroides hippolytes (3 E).

The whole of this group seem to be species which come from the Pacific, migrating from there eastwards round the north of America. As they are boreal on the whole and most do not occur at arctic America, the migration cannot have taken place under the present climatic conditions, but probably during an earlier, postglacial period, when Greenland had a warmer climate than now, as shown by Ad. S. Jensen (On the Mollusa of East Greenland, I. Lamellibranchiata; On the fossil quaternary Mollusc-Fauna of Greenland; Meddel. om Grønland, vol. 29, 1909, pp. 289—305. — Ad. S. Jensen and Poul Harder: "Postglacial changes of climate in arctic regions as revealed by investigations on marine deposits"; Postglaciale Klimaveranderungen (Geologorum conventus), Stockholm 1910, p. 399). It is interesting, that Dr. Th. Mortensen has shown the same thing in regard to certain Echinoderms (Echinoderms — — — Danmark Exped., Meddel. om Grønland, vol. 45, 1910, pp. 298—300). *Chionoecetes opilio*, *Spirontocaris Fabricii* and *Sp. macilenta* have not come further than to W. Greenland, *Nectocrangon lar* and *Spirontocaris groenlandica* have also reached E. Greenland; the remainder have come much further.

The Atlantic deep-water fauna (including the plankton) seems for a great part to be cosmopolitan (except naturally in the cold polar basin). The Danish "Ingolf" Expedition first showed the difference in the deep-water fauna of the Atlantic and Polar Sea (H. Jungersen, "Fra "Ingolf" Expeditionen", Geografisk Tidsskrift, vol. 14, 1898, p. 36). It will have been noticed in the lists above, how many of the Greenland deep-water species have been found in the Pacific or even in the Indian Ocean.

Our knowledge of the Greenland plankton has been obtained mainly, as already indicated, from the Danish "Tjalfe" Expedition to W. Greenland under the direction of Ad. S. Jensen in 1908—09. This Expedition, which was sent to Greenland to study the possibilities of a profitable fishery, brought home a very large material, also of Crustacea. A paper on the Malacostraca of the Expedition will very soon appear (in Vid. Medd. fra Naturh. Foren. Kbhvn., vol. 64, 1912), and it will be shown therein, that many of the plankton forms, which were known earlier from the Atlantic between the Azores and S. W. Ireland (see especially Bull. Mus. Océanogr. Monaco; Result. des camp. sc. — — — Albert I, Monaco; Fisheries, Ireland, Sci. Invest.) have also now been found right up at the ridge in the Davis Strait; this material, however, has also been used in the present work.

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Explanation of the Plates.

Pl. XXXIX.

A. Young stage of Spirontocaris (groenlandica Fabr.?), figs. 1—10 (p. 516).

Fig. 1. General appearance.
- 2. 1st and 2nd pair of antennae, eye.
- 3. Mandible.
- 4. 1st pair of maxillae.
- 5. 2nd do.
- 6. 1st pair of maxillipeds.
- 7. 2nd do.
- 8. 3rd do. , 1st—3rd pair of pereiopods.
- 9. 2nd pair of pleopods.
- 10. Uropod and telson.

Pl. XL—XLI.

B. Young stage of a Spirontocaris, figs. 11—20 (p. 518).

Fig. 11. General appearance.
- 12. 1st and 2nd pair of antennae, eye.
- 13. Mandible.
- 14. 1st pair of maxillae.
- 15. 2nd do.
- 16. 1st pair of maxillipeds.
- 17. 2nd do.
- 18. 3rd do. and 1st, 2nd and 4th pair of pereiopods of the left side. Fig, 18a. the 2nd pair of pereiopods of right side.
- 19. 3rd pair of pleopods.
- 20. Telson and uropod. Fig. 20a. The tip of the telson.

Pl. XLII.

C. Young stage of a Spirontocaris, figs. 21—30 (p. 521).

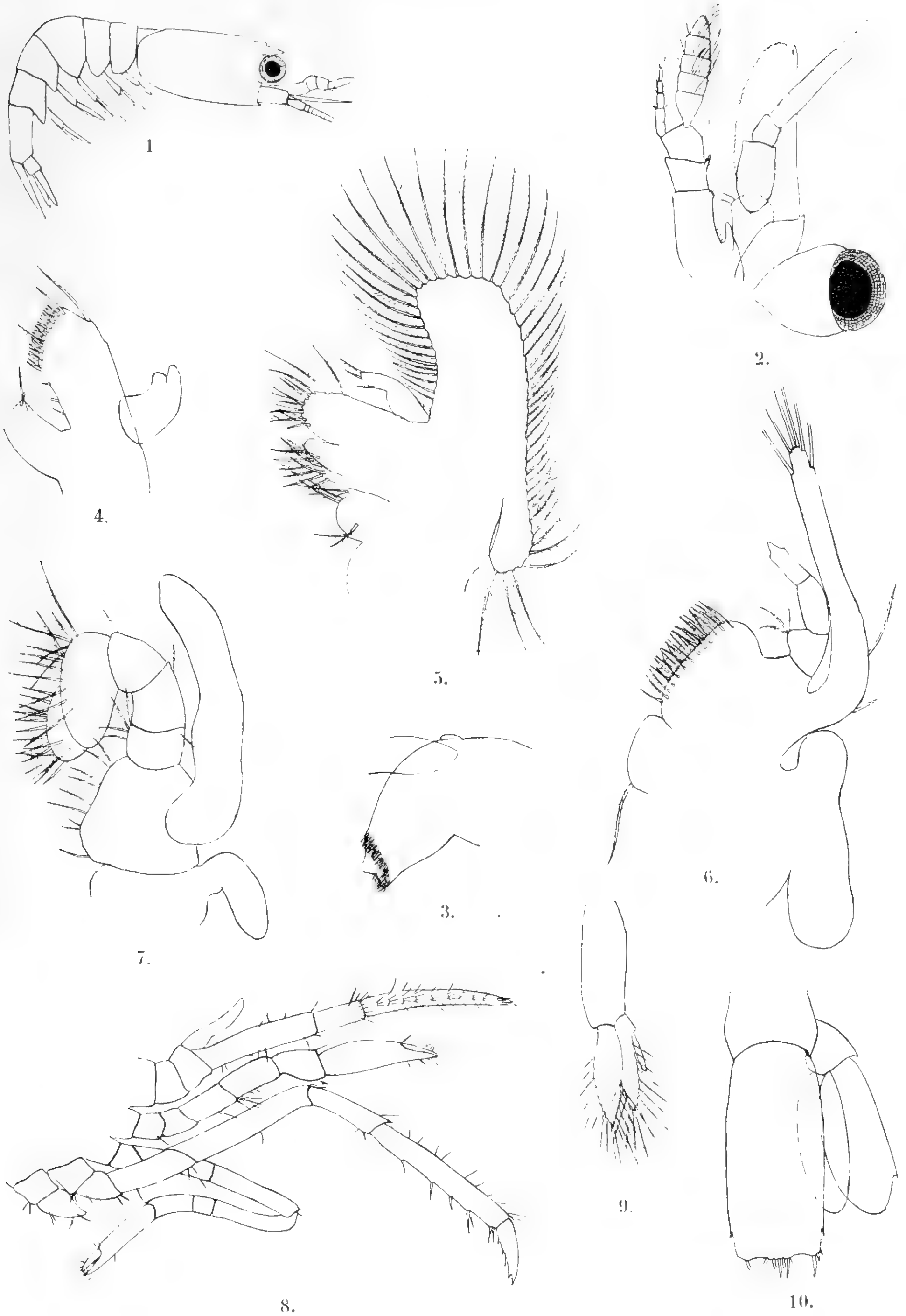
Fig. 21. General appearance; at the side, the anterior part of carapace, seen from above.
- 22. 1st and 2nd pair of antennae, eye.
- 23. Mandible.
- 24. 1st pair of maxillae.
- 25. 2nd do.
- 26. 1st pair of maxillipeds.
- 27. 2nd do.
- 28. 3rd do. and 1st and 2nd pair of pereiopods.
- 29. 3rd—5th pair of pereiopods.
- 30. Telson and uropod.

Pl. XLIII.

D. Mysis stage of a Spirontocaris (?), figs. 31—39 (p. 522).

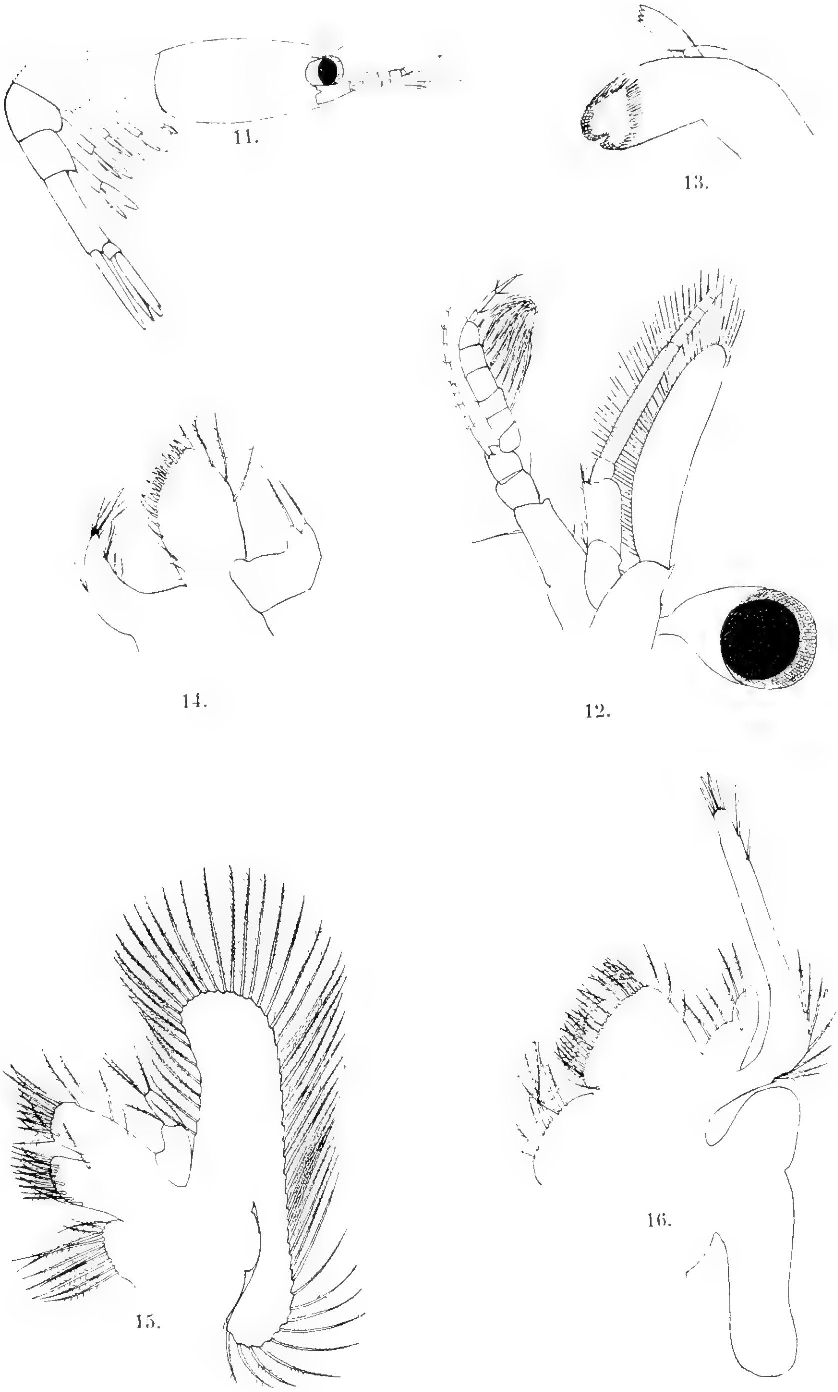
Fig. 31. General appearance; 31 a. the carapace seen from above.
- 32. 1st and 2nd pair of antennae.
- 33. Labrum.
- 34. Mandible.
- 35. 1st pair of maxillae.
- 36. 2nd —
- 37. 1st—3rd pair of maxillipeds, 1st—5th pair of pereiopods.
- 38. 1st and 5th pair of pleopods.
- 39. Telson and uropod.

Alphabetical list of the species.



K. Stephensen del. Typ. Bianco Luno

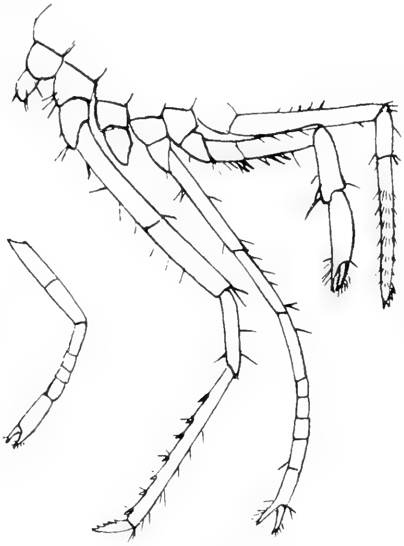
A. Young stage of Spirontocaris (groenlandica Fabr?.) (p. 516).



K. Stephensen del.

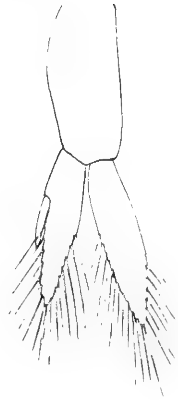
Typ. Bianco Luno.

B. Young stage of a Spirontocaris (p. 518).



18 a.

18.



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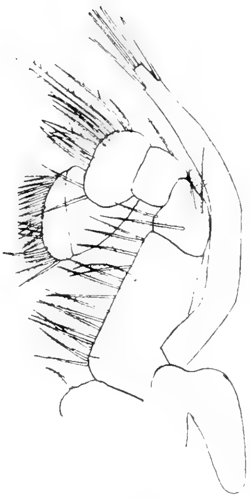

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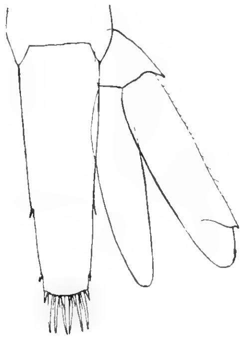


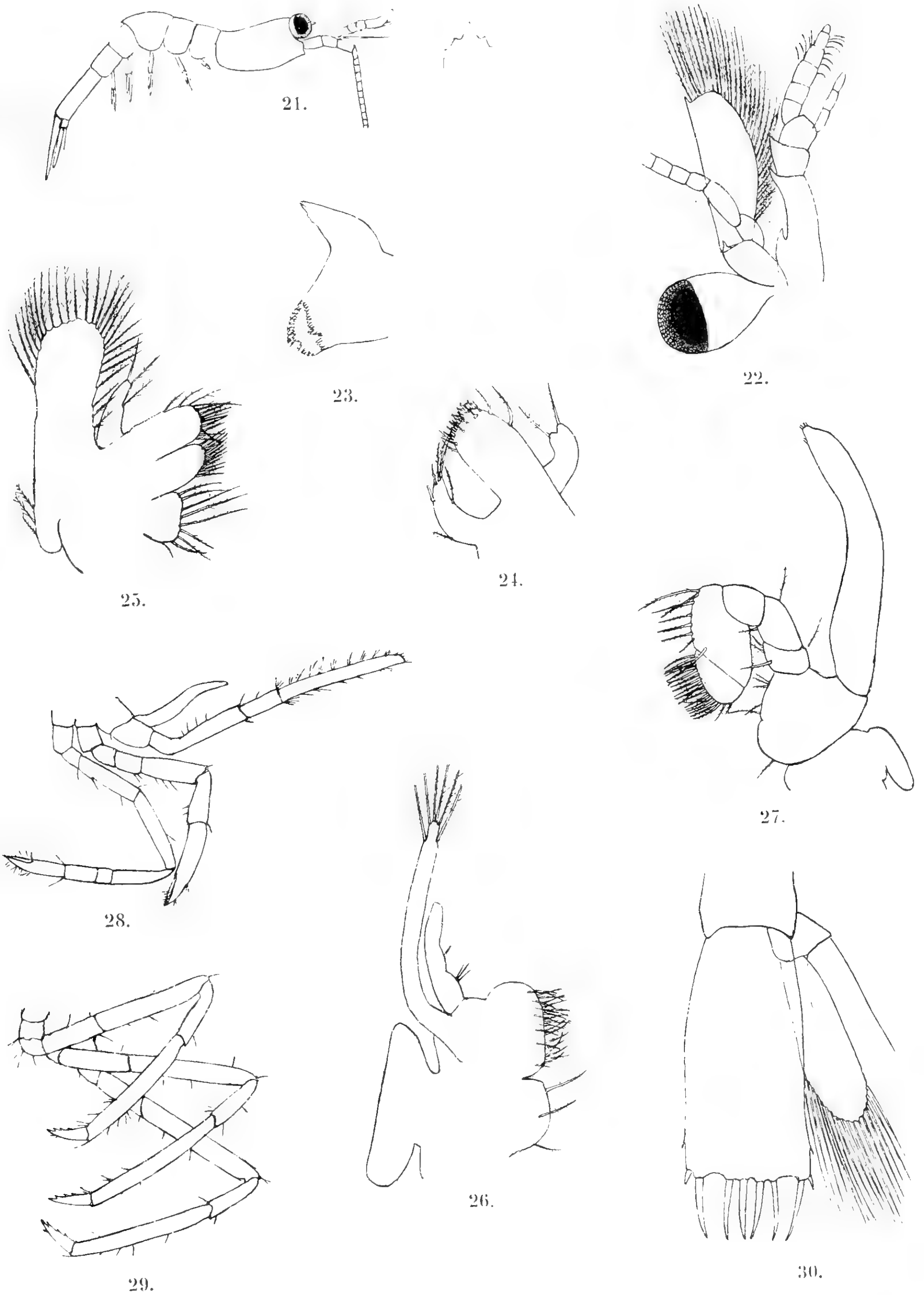
20.

20 a.

K. Stephensen del.

Typ. Bianco Luno.

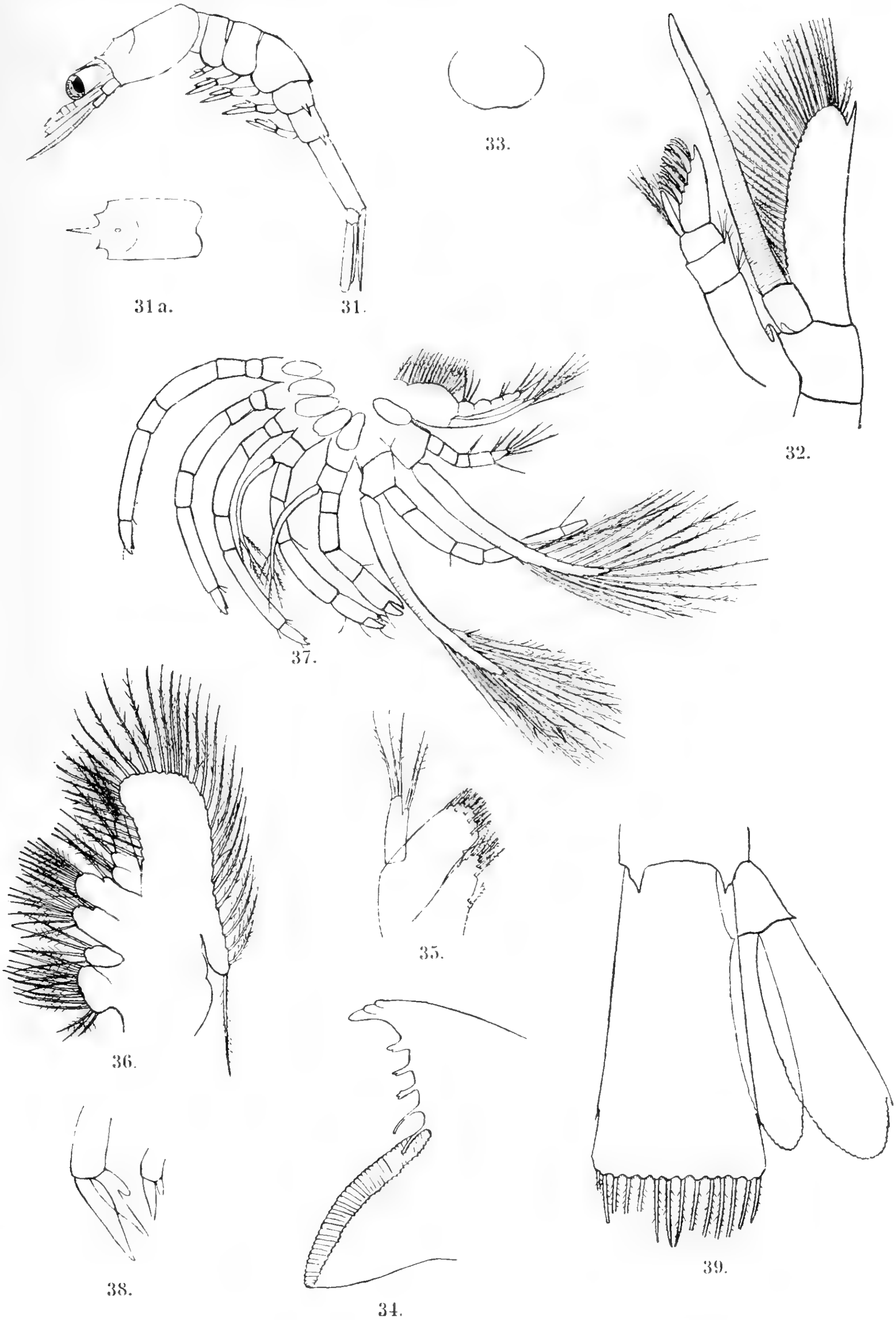
B. Young stage of a Spirontocaris (p. 518).



K. Stephensen del.

C. Young stage of a Spirontocaris (p. 521).

Typ. Bianco Luno.



K. Stephensen del.

Typ. Bianco Luno.

D. Mysis stage of a Spirontocaris (?) (p. 522).

XII.

THE FISHES OF THE DANMARK EXPEDITION

COLLECTED AND DESCRIBED

BY

FRITS JOHANSEN

1912

Of the fishes mentioned in the sequel a few have been taken on the voyage through the field-ice in towards the north-east coast of Greenland in 1906 and again on the passage outwards in 1908, but the great majority have been collected during the stay of the Expedition at ca. 77° N. L., partly in Danmarks Havn, partly in the surrounding waters.

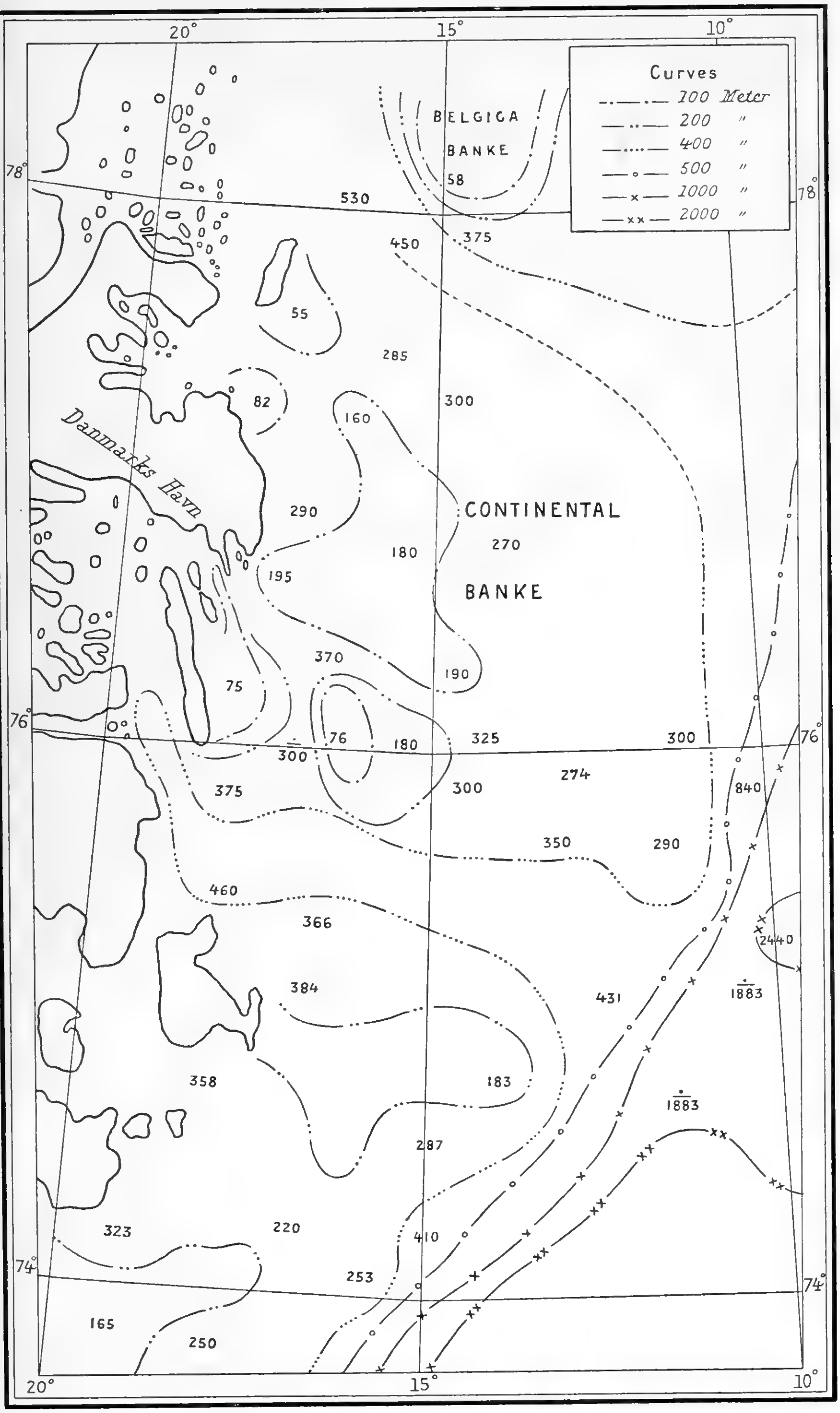
In such high latitudes the fishing must be carried on chiefly in the summer-time, when there is open water, but even then the conditions may be less than favourable. When, as was my experience during the two years we passed there, the ship lies at anchor or frozen in at one spot for the whole of the time and the only way of getting about in the summer is by means of a boat, it can be readily understood, that the amount of work done is in reality determined by the ice. In the morning, for example, the harbour and the fjord may be quite free of ice; in the middle of the day a quantity of drift-ice perhaps comes floating in and in the evening the open water may be quite filled with densely packed ice. Another day again the harbour might be filled with ice, but open water present outside in the fjord where the current was running — but too far away to get at with the heavy motor-boat. My aim was, therefore, to go as far away as possible whilst there was open water near the ship and to work without break at one definite spot so long as the conditions permitted. Fortunately, at this time of year there is light throughout the 24 hours, and if I had been able to rely upon more assistance, the results would certainly have been greater. Sometimes I was obliged to do everything for myself, row the boat, fish, preserve, take notes etc., to get anything done at all. In September the investigations became difficult owing to the formation of the thin ice, and by the middle of the month this had become thick enough to prevent the passage of the boat at most places. Throughout the winter the fishing was restricted to the open channels or holes made in the ice — provided that the

currents and new ice did not quickly close up the openings. When the sea-ice melts in July, this takes place off the water-courses, which have begun to run on land and carry down larger or smaller quantities of water out over the sea-ice. The latter is then gradually "eaten away" by the fresh water and channels or basins are thus formed with open water near the land. In these I began work already at the beginning of the month and as the open water gradually spread further and further out, forming holes and channels in the sea-ice, I was able to dredge along the margin of the ice for long distances and out into deeper water. Or I rowed about in the

Fig. 1. The author dredging.

open water, towing the dredge behind; then anchoring on the edge of the ice I hauled in the apparatus (see fig. 1). In the month of August, lastly, the harbour and the fjord outside became free of its icy cover and the boat could be taken for long distances.

In unfavourable summers, however, the sea-ice does not break up at all over large distances (inner parts of the fjords), even though holes and channels may be formed in the ice; and unfortunately this was the case just in the summer of 1907 when we lay there, so that I had also to fight against this hindrance. The other two summers were more favourable as regards ice, but in the one case we were so late (end of August 1906), in the other left so early (end of July 1908), that the amount of work done in this direction


Curves
100 Meter
200 "
400 "
500 "
1000 "
2000 "
BELGICA BANKE
Danmarks Havn
CONTINENTAL BANKE
20°
15°
10°
78°
76°
74°

could not be very great. And when it is remembered, lastly, that the regions visited were absolutely unknown, with regard to cartography, hydrography, biology etc., it will be understood that a definite plan of investigations could only be formed gradually.

A few contributions have been made to the fish-fauna from the investigation of the stomachs of seals (*Phoca foetida* L.), birds (especially *Larus eburneus* Phipps) and also fishes (*Salmo alpinus* L.), as also from the few occasions (Maroussia Island, July 1907) when I obtained dead fish from openings and channels in the ice (through which they had been pressed up by currents) or when I have found

Fig. 3. Hauling the seine to land.

them washed up on the beach at several places. Of more value however was the use of the ice or boat (motor, rowing or sailing boat) for the investigations, as also when the ship was on the voyage in and out of Danmarks Havn.

With regard to apparatus, I have used for the deeper water the Sigsby, shrimp and young-fish trawls, as also large dredges and plankton-net; in shallower water bottom-traps, cod and salmon nets, hooks and pilk etc. The two apparatus which have been most useful were, however, the eel-seine (yet only on soft ground) (fig. 3), which is easy to work and yields a rich harvest especially of fish, and dredges, of which I had several forms at my disposal, for hard and soft bottom and all sizes from large to quite small. The dredge

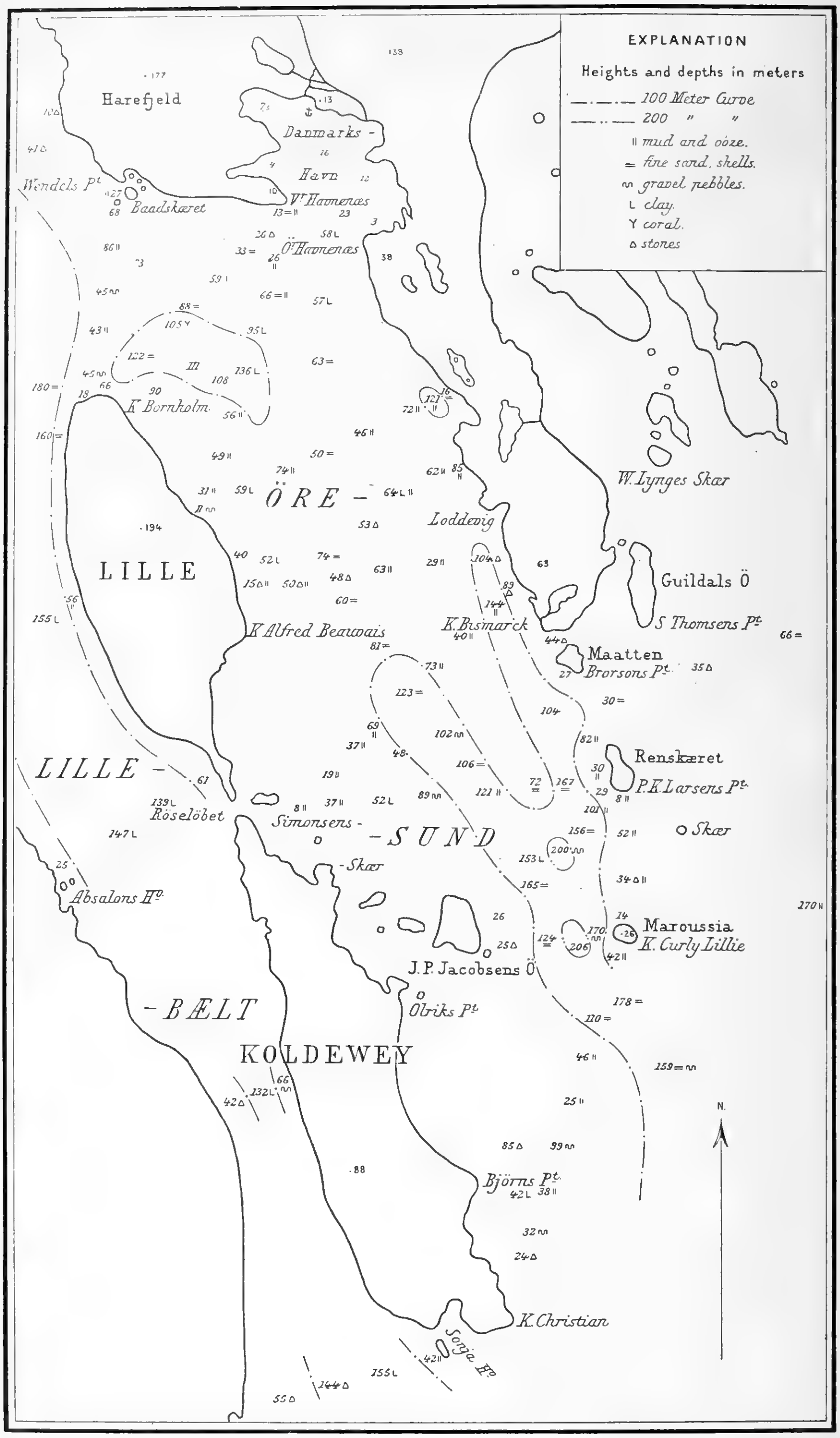
has also the advantage that it can be worked by one man and for this reason I often used it in conjunction with a landing net or h a n d - d r e d g e.

With regard to the natural conditions in the freshwater lakes of North-East Greenland and the animal life contained in them, reference may be made to my earlier paper[1].

The general features of the hydrographical conditions in the waters of North-East Greenland may be just briefly discussed, on the basis of Captains Trolle's observations and my own, as well as on the results of other expeditions. As will be seen from the accompanying Chart (fig. 2), the 500 m curve off North-East Greenland runs parallel to the main direction of the coast at a distance of 5—10 degrees of longitude from it. On the other hand, the 400 and 300 m curves are much more irregular, and this applies especially to the 200 m curve. The 100 m curve naturally follows the line of the coast even more than the preceding. On the Belgica Bank (ca. 78° N. L., ca. 15° W. L.) we meet with shallow water (about 100 m) whilst round about the depths are over 500 m. In the fjords round about Danmarks Havn (see fig. 4) only some isolated spot have depths over 200 m; a depth of 100—200 m is only found for a short distance into "Øresund", whereas it extends through the whole of the "Lille Bælt" and "Storebælt" and has a wide distribution both in Stormbugt and in the more westerly Dovebugt. In depths of less than 100 m we find submarine ridges here and there (e. g. from Baadskær to Koldewey Island).

A large number of soundings were made in Danmarks Havn (by two members of the Expedition, Bistrup and Ch. Poulsen) and from these we can form a much more exact picture of the depths, and the importance of knowing this locality in more detail is so much the greater as the fish taken come more especially from here. Owing to its position (both on a fjord and in the neighbourhood of the sea outside), the nature of its bottom-soil (soft and hard) and the depth (down to ca. 60 m), this locality may also be taken as type for the shallow-water areas of those regions. From the adjoining Chart (fig. 5) it will be seen, that the 5 m curve follows very closely the line of the coast; this is also the case, though to less extent, with the 10 m curve, but the 20 m curve is extremely irregular, as it forms the boundary between the shallow water (below 20 m), which fills the greater part of the basin, and the deeper layers (over 20 m) which in a broad tongue push from the fjord into the harbour, where the tongue branches irregularly in the

[1] "Fresh-water life in North-East Greenland" by Frits Johansen. Danmark-Ekspeditionen til Grønlands Nordøstkyst 1906—08. Bd. V. N. 6. Kbhvn. 1911.


EXPLANATION
Heights and depths in meters
100 Meter Curve
200 " "
mud and ooze.
fine sand, shells.
gravel pebbles.
clay.
coral.
stones
Harefjeld
Danmarks -
Havn
Vr Havnenæs
Baadskæret
Wendels Pt.
Or Havnenæs
K. Bornholm.
ÖRE -
Loddevig
W. Lynges Skær
Guildals Ö
S Thomsens Pt.
LILLE
K. Alfred Beauvais
K. Bismarck
Maatten
Brorsons Pt.
Renskæret
P.K. Larsens Pt.
Skær
LILLE -
Röselöbet
Simonsens -
- Skær
- SUND
Absalons Hd.
Maroussia
K. Curly Lillie
J. P. Jacobsens Ö
Olriks Pt.
- BÆLT
KOLDEWEY
N.
Björns Pt.
K. Christian
Sonja Hd.

outer and central parts. Apart from a small, isolated part off Nordre Havnenæs, we only find a depth of 30 m in the middle of the entrance to the harbour, and the curves of this and greater depths (40, 50, 60 m) lie almost concentrically there.

The temperature and salinity of the sea-water are distributed in the main as follows. The Greenland Sea can be divided into three regions: 1) the Spitzbergen plateau, 2) the deep central region and 3) the East Greenland plateau. Only the last concerns us here. It is entirely filled by the East Greenland Polar Current, with the result, that the temperature and salinity of the water are low. In the surface-water the salinity (at least in summer, when the snow and ice are melting) is below 32 ‰, this isohaline following fairly exactly the 500 m curve (in deeper water the salinity at the surface is over 32 ‰; it is highest where there is no ice). The temperature is in general higher than — 1°. The surface-water has an even thickness of ca. 20 m. Below this and down to ca. 150 m the water has a salinity of 32—34 ‰ and a temperature of — 1·8°. Lower down (to ca. 300 m) the salinity is 34—35 ‰ and the temperature is from negative to a little over 0°. Lastly, in the lowermost ca. 200 m there is water with a salinity of over 35 ‰ and a temperature of up to + 1°; it is presumably an extension from the bottom-water in the great depths outside. The conditions described are found in the outer part of the coastal plateau; but in corresponding depths nearer the coast (0, 50, 100, 200, 300, 400 and 500 m) we find corresponding temperatures and salinities. In the fjords round about Danmarks Havn, where the depths are as described above the surface-water is more or less mixed with fresh-water according to the time of year. In the fjords where there is no submarine ridge ("Lillebælt" and "Storebælt"), the salter, deeper water is able to penetrate inwards, preserving approximately the same salinity and temperature as outside; but where there are ridges, only the surface and upper layers can pass and in the deeper holes referred to above (e. g. in Stormbugt) the circulation in the deepest layers (over ca. 200 m) is very slow, and both the salinity and temperature are therefore lower than at the corresponding depth in "Lillebælt" and "Storebælt" as well as in the sea outside. —

In regard to the nature of the bottom-soil we may again take Danmarks Havn as type. We can distinguish in general between two main kinds of bottom-soil, namely, soft and hard. By the former I understand clay or mud more or less mixed with sand; often we also find a number of loose stones in it. When these are specially numerous or large, however, the soil changes to hard, i. e. it consists of numerous, rounded stones with shells; or the rocky

nature appears here and there, covered only with a layer of sand. In Danmarks Havn the soft kind of bottom-soil is much more widely distributed than the hard owing to the sheltered situation. The hard bottom is found at places where the currents are strong (e. g. at the entrance to the harbour); further at several places in the neighbouring fjords (Stormbugt, Øresund etc.) and outside the

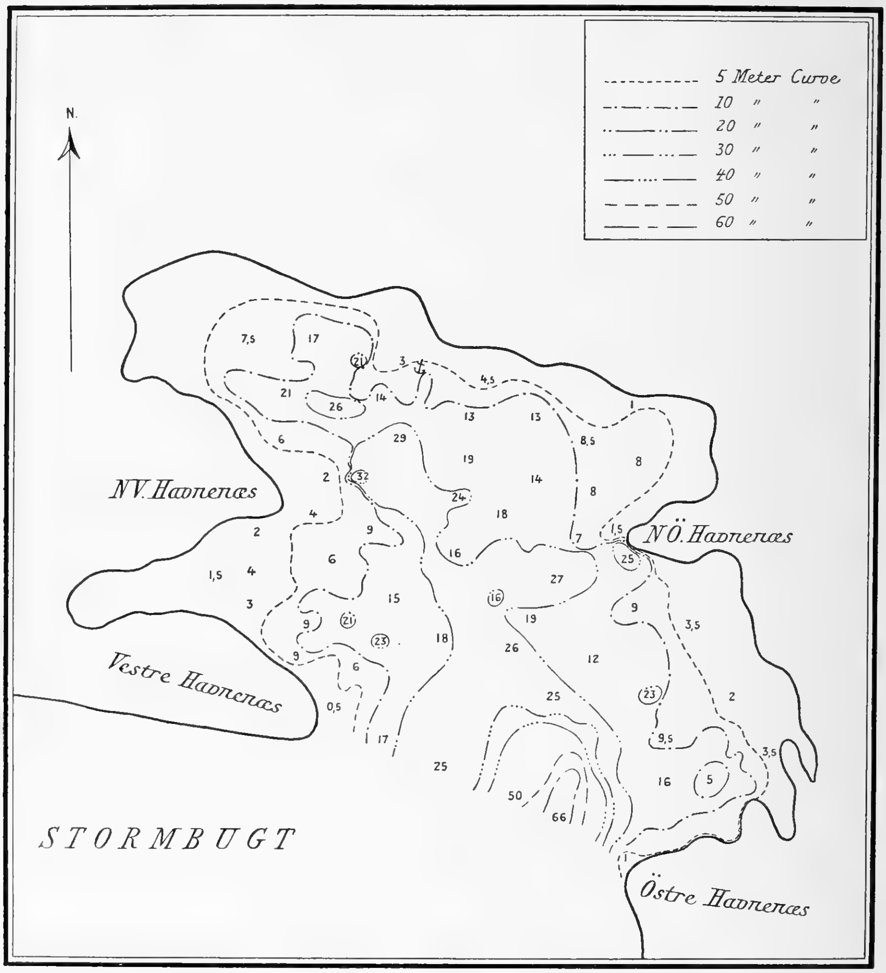


Fig. 5. Depths in Danmarks Havn.

coast, for example, at below 200 m off the whole of Germania Land and at 300 m at one place there.

If we can thus say regarding this bottom-soil, that it is common at less than ca. 100 m (in the fjords we have at this depth rocks, stones and gravel nearest the shore, sand further out) but in deeper waters only occurs as banks here and there[1], the soft bottom-soil

[1] This holds good in much less degree for the fjords than for the sea outside the coast.

on the other hand, though often occurring at less than ca. 100 m (in the fjords the clay is mostly mixed with sand nearest the shore, but pure further out), has a much greater extension in greater depths. In the form of clay, sand (sometimes a few stones and shells) or a mixture of both, it covers the deeper channels in the fjords (e. g. at over 100 m in Lillebælt and Storebælt) and most of the sea-bottom (except the above-mentioned banks with hard bottom) in the deeper parts of the coastal plateau and outside this, as has been shown by the Danmark and earlier Expeditions (see Böggild's Chart in "Belgica" (Croisière ocèanographique dans la mer du Groenland 1905. Bruxelles 1909)).

We may return again to Danmarks Havn to give a general outline of the vegetation of the bottom. As a special work on the algae collected on the Expedition has already been given[1], I shall merely give here a general, floristic account of the algal vegetation in Danmarks Havn and neighbouring waters, based on the results of my dredgings. Both for the fishes and for the other marine animals the algal vegetation is so important, that a little more detailled description of it will be of use, especially as I am able to give a fairly complete and exact picture of it, which has not been attempted from the botanical side (and it would have been difficult to do so owing to the absence of direct observations). Keeping first of all to the hard bottom, we find that all algal vegetation is lacking in the uppermost ca. 2 m at the places, where the ice has been free to rub against the foot of the cliffs, whilst a few algae (*Fusus inflatus* L.) are found at sheltered places (clefts in the rocks, shallow bays with rocks on the bottom), where they often grow right up to the surface of the water. In a little deeper water (down to ca. 5 m) this typical, littoral alga is accompanied by others (*Enteromorpha prolifera, Rodochorton Rothii, Calothrix scopulorum* etc.) and together they form the true littoral region, which can thus be taken to lie between 0—5 m. At 5 m the character of the algal vegetation changes, the Chlorophyceae being less prominent and Fucus common; in addition to the latter we now find also the other Phaeophyceae (*Laminaria saccharina, L. solidungula, Alaria Pylaii* etc.) which give this region its character and form the most copious vegetation of the arctic sea. Whilst this Laminaria region is thus a continuation of the littoral region, it on the other side completely changes its character at a depth of ca. 15 m, the brown algae becoming replaced by red and calcareous

[1] On the Marine Algae from North-East Greenland, by L. Kolderup-Rosenvinge (Danmarks-Ekspeditionen til Grønlands Nordøstkyst 1806—08. Bd. III. Nr. 4. Kbhvn. 1910).

algae (see below). At places where the currents are strong (sounds, mouths of fjords) the littoral region is almost entirely wanting or rather, it is one with the Laminaria region, as we often find the brown algae mentioned already at ca. 2 m along with the littoral, green algae. At the same time, if the depth permits it, the Laminaria vegetation may go out to greater depths than elsewhere (down to ca. 20 m), probably because the salinity of the water and the current here afford it excellent conditions of growth. But however great the extension of the Laminaria region may be, it attains its greatest profusion and most typical appearance between 5—10 m.

At a depth of ca. 15 m the algal vegetation consits of the foliaceous Rhodophyceae, *Delesseria sinuosa, Polysiphonia arctica, Phyllophora* etc. and the Corallinaceae, *Lithotamnion laeve, Cruoria arctica* etc. The last are most predominant, clothing the many, loose stones, shells of animals etc., whilst the Florideæ are more scattered. I call this form of vegetation therefore the Lithotamnion region and use the name Delesseria region for the corresponding algal vegetation on the soft bottom. I take 20—40 m for the characteristic depth of the Lithotamnion region, that is, this vegetation reaches its maximum here, even though found in shallower and deeper water. At a few places indeed it is found at a surprisingly shallow depth (ca. 10 m), as the Laminaria region for one reason or another only reaches out to this; and in general its transition to the following deeper region, the Hydroid region, is quite even (first the foliaceous and later the calcareous algae becoming fewer and fewer). This characteristic vegetation, which attains its richest development at ca. 50 m, consists of more or less dense mattings of hydroids (of these not a few *Lafoea fructicosa, Sertularella tricuspidata* are already found in the Lithotamnion region), including *Lafoea serpens* and *Halecium muricatum,* in addition to a few which are common to these two regions, e. g. *Cuspidella procumbens, Eudendrium rameum*[1].

These hydroids find excellent conditions for their growth on the many, loose stones, mollusc shells, Balani etc. along with the algae; and to how great an extent they are bound to these is seen from the fact, that here and there we find spots with sand and gravel (probably with rock underneath), where the vegetation is extremely sparse, as also from the fact, that this region is quite wanting on the soft bottom which is free of stones. Passing still further out (to over ca. 50 m) the hard bottom appears as banks here and there; the algal vegetation is still thinner and the hydroids change their character at ca. 100 m (other species: *Lafoea grandis,*

[1] See also "Report on the Hydroids" by P. KRAMP in this work, Bd. V, Nr. 7. 1911.

Sertularella gigantea, Thujaria laxa). Here we find among other things numerous coral-like colonies of Bryozoa, and from these I have called this region the "coral bottom". At some places it is also met with at 300 m, replaced here and there by bare sand and gravel banks as in the hydroid region.

We may turn now from the hard bottom to the corresponding conditions on the soft bottom. This is found for example over the greater part of Danmarks Havn, the coasts here being for the most part raised sea-bottom in the form of level sand, gravel or clay plains; and these continue out under the water, so that the depth increases slowly. At several places water-courses flow out into the harbour (or have done so) and the material brought down by these contributes by deposition to level up and cover the bottom with a soft layer. Regarded as a whole the littoral region at these places has a very poor vegetation; there is even no vegetation at all over wide areas, especially sandy areas, but in the shelter of large stones we find a few *Fucus*, or masses of sea-weed (especially stumps of Laminaria, Chlorophyceae etc.) lie here and there (especially in the bays). This applies in still higher degree to the Laminaria region, as the amount of loose algae is often greater than the quantity of the fixed (in contrast to the hard bottom), and in less degree to the succeeding Delesseria region. Off the larger rivers the vegetation of algae is poorest, probably owing to the large quantity of fresh water and the constant deposition of sand; often however we find here the washed-out remains of moss and other freshwater and land plants, especially when the rivers begin to flow. A true littoral, algal vegetation is thus wanting here, and the Laminaria region also begins further out (ca. 10 m) than elsewhere. This region also has its main distribution about 10 m, beginning usually at 5 m (if there is but one loose stone, to which the algae can attach themselves to) and it extends out to ca. 15 m, at places even to ca. 20 m (where the water is specially clean). At the latter depth it changes over into the Delesseria region, which is characterized by red algae (mentioned on p. 642), and these beautiful foliaceous algae also attain here a much greater distribution than on the corresponding Lithotamnion region. The calcareous algae, on the other hand, are scarcer here, being more numerous the more the bottom-soil approaches to the hard bottom (stones, shells). This red-algae region extends out to very deep water on the soft bottom, the algal vegetation gradually becoming scarcer; a hydroid and coral region are wanting naturally with the stones. The Delesseria region has its typical form at ca. 20 m and extends out to ca. 50 m. Beyond this depth we might perhaps set up a

fourth region, namely, a region with mud and sand bottom with a few red algae (most numerous when stones are present). And at a depth of over ca. 100 m we meet with the mud and sand bottom with or without stones and without vegetation; this region has already been mentioned p. 642.

Comparing the conditions described, we see that the various algal vegetations on the hard bottom are as a rule more sharply marked from one another and have a less extension than those on the soft bottom. These characteristics in conjunction with the qualitative differences of the vegetation, the copious or sparse growth (sometimes quite lacking), the presence of fixed or loose-lying algae, are certainly produced partly by the ice, partly by the currents at the different places; the places with strong currents are preferred by special algae (Laminaria), and thus these occur especially on the hard bottom, whilst the soft bottom has most algae when loose stones are abundant or when the water is sufficiently deep.

It would seem natural also, along with this sketch of the algal vegetation, to give an account of the invertebrates occurring in the different regions. As the collections brought home have only partly been worked up, however, I must postpone this to a later occasion. So much may be said, however, that just as there is a distinct difference in the animal forms which live on hard bottom (characterized by larger Mollusca, a few Crustacea, *Caprella arcturus* and masses of Hydroids and Bryozoa) and the fauna living on soft bottom (small Mollusca, numerous Crustacea, masses of worms), it is also a striking fact that the fishes live almost exclusively on the soft bottom (or have their main distribution there), since, namely, their principal food is found there.

Cottus scorpius L.

This fish has been taken at a definite depth, namely ca. 3—15 m (soft bottom of the littoral and Laminaria regions), both in Danmarks Havn and elsewhere in the neighbourhood (at Hvalrosodden off Store Elv). It lives preferably in sheltered places with rich algal vegetation, but it seems to be far from common in these northern latitudes. The depths in which it lives were investigated a number of times, and whilst other fishes e. g. *Icelus hamatus* Kr., *Triglops pingelii* Reinh. and *Gadus saida* Lep. occurred in hundreds and *Cottus quadricornis* L. in tens, only about half a score of *Cottus scorpius* have been taken (both old and young specimens). Comparing this result with its occurrence on the southern part of the east coast[1],

[1] AD. S. JENSEN: The fishes of East Greenland. Meddel. om Grønland XXIX. Copenhagen 1904, p. 239.

where it is extremely common (also occurring in deeper water), it is possible that 77° N.L. forms a northern boundary for this species. Just as in Denmark it occurs both in salt and brackish water; nor does it seem to be troubled when the water of its habitat becomes quite fresh from the rivers (Hvalrosodden). All the specimens taken are from July and August 1907; the smallest were 50 mm and of the larger there were 2 ♂ (178 and 205 mm) and 1 ♀ (over 200 mm). The last (from 24/7) had relatively large eggs; in the stomach of the ♂ of 205 mm were numerous, large Chaetopods, a few Amphipods and a parasitic Nematode.

Regarding the colour of the fish, I have made two coloured sketches from life and noted the following. At a size of ca. 50 mm the fish is easily distinguished by its large head and the short body and tail; under the 2nd dorsal fin the dark-brown colour of the back forms a characteristic marking against the light belly. The fins have a fine, rose-red longitudinal streak partly on the skin partly on the rays (except the ventrals, which have the light colour of the belly). At a length of 178 mm (♂) the red streaks on the fins of the younger fish have become overshadowed (except on the outer margin) by alternating yellow and black cross-bands (in number 2—3 + 2—3), which are specially distinct on the rays; the ground-colour of these fins (that is, except the ventrals) is gray. The ventrals and the underside of the head are light-coloured; the former have 3 + 3 alternating, broad, yellow (outermost) and red (innermost) cross-bands. The jugular region is light-yellow, the belly pinkish with the characteristic, rounded, whitish-yellow spots. The dark-brown colour on the upper side of the fish does not differ from the well-known, characteristic marking in the more southerly forms. The female of over 200 mm was found dead in the water, and its colour was thus greatly bleached; so far as I could see, its colours were almost like those of the males, only slightly fainter.

Cottus quadricornis L.

This species differs from the foregoing in that it is mainly distributed in the littoral region (down to ca. 10 m), though a few are also found in the deeper Laminaria region. It is also much more abundant than *C. scorpius* in contrast to what is the case further south along the east coast[1] (where it is taken in the same depth), and as I have been able to observe this fish in the living condition in it snatural surroundings, I have no hesitation in naming it as the typical fish of the littoral region. If we row in a boat over depths where the bottom can be seen the whole time, we can

[1] Ad. S. Jensen: l. c. p. 228.

often catch sight of this fish, lying quite still and luring on its booty (it likes especially to conceal itself in the loose sea-weed; see Introduction); they move about lazily when the shadow of the boat reaches them and only swim away more energetically when stirred up with a boat-hook. Both the older and younger specimens occur here, and even the pelagic stages (which in the case of most other fishes are found in greater depths) are taken right into the beach in Danmarks Havn, where they swim about actively at the surface by means of their large pectorals and movements of the tail. Like *C. scorpius* this fish is caught in the freshened water at Hvalrosodden; in winter the thickness of the fjord-ice probably forces it out into a little deeper water (Laminaria region). All the specimens taken are from the harbour and neighbouring waters, July and August 1907 (everywhere soft bottom). About 20 specimens in all were taken, which in regard to size and sex were as follows:

♀ 275, 270, 263, 260, 190, 170, 133, 121 mm
♂ 205, 192, 168, 165, 155, 155, 145, 137, 128, 121 —

Of these most had large eggs or well-developed testes (blue-gray); the males already at ca. 150 mm, the females on the other hand only at ca. 250 mm (the largest eggs in the ovary vere $1^{1}/_{2}$ mm in diameter, the smallest $^{1}/_{2}$ mm). The stomachs contained chiefly the common, littoral Amphipods, further a few *Mysis oculata* and some parasitic Cestodes.

Of the tiny larvae mentioned above, 3 were taken close to the beach in Danmarks Havn 24—7—07 and measured 19—20 mm; 2 others were caught the following year (19—7—08) at the same place and measured the same, but were older in development. They represent a hitherto unknown stage between larvae of ca. 13 mm, hatched out by SUNDEVALL in the large Swedish lakes and described by him[1], and the larvae of 21·5 mm mentioned by AD. S. JENSEN from East Greenland[2], and they may therefore be described here in more detail (see Pl. XLVI, figs. 11—13). They were taken in quite shallow water (1 m) and the bottom consisted of mud-covered rocks ("Skærver"); of the 3 taken in 1907 I succeeded in keeping one alive in salt water for a whole day, although the gut had not yet broken through at the anus and it took no food. To begin with, it swam about actively in the glass, but when half the day had passed it lay mostly on the bottom and only came up to the surface now and then (though I changed the water and placed a little food in it). The other two larvae were preserved immediately after capture, as also the two from 1908. But unfortunately they

[1] Kgl. Vetensk. Akadem. Handl. Bd. I, Pl. I, figs. 5—8. Stockholm 1855.
[2] l. c. p. 237.

became completely frozen in the formaline in the course of the winter, so that their form, fin-rays etc. were spoilt in part. From the living specimens, however, I made the following observations (larvae of 1907; Pl. XLVI, fig. 11).

The anus lies somewhat in front of the middle, the distance from anus to end of the tail being 12 mm and from anus to snout 8 mm. The pectorals are very large, reaching to the anus, and have fully developed rays; the first dorsal is distinct from the second, which is the longest and highest; the rounded caudal is connected by a membrane with the second dorsal and anal fins; the latter is just as broad as D^2 and reaches forward right to the anus; posteriorly it ends a little before D^2. All these fins have rays (which could not be counted with certainty however), whereas the ventral fins are only present as rudiments. There are 2 distinct spines in the occipital region (the hindmost pair in the adult), but neither nasal nor frontal spines are to be seen; on the other hand the curved row of rudimentary spines are distinct on the preoperculum. The root of the tail is distinctly bent upwards, and the lower, plate-like hypural elements are well-developed.

The larvae from 1906 differed from the foregoing in that they did not have the larval form, and the rudiments of the spines, pigmentation, fins etc. were more developed. The specimen of 19 mm (Pl. XLVI, fig. 12) had a characteristic form, which I may call cod-like, to mark the stage between the larval form and the adult. Its pectorals are still larger than in the 3 foregoing and the ventrals are more distinct and the unpaired fins more sharply marked off from one another (though the connecting membrane is still present). The spiny equipment of the head is almost as well-developed as in the specimen of 20 mm. The hypural bones by their growth have made the base of the tail more square-shaped posteriorly. — The specimen of 20 mm (Pl. XLVI, fig. 13) greatly resembles that figured by Ad. S. Jensen. The head is flattened above and large in proportion to the trunk; the whole form of the fish is now distinctly "scorpion-like". The two occipital spines are now large and distinct and the 2 frontal and the 2 nasal spines are indicated; the preopercular row is also distinct[1]. The rays in the unpaired fins are now very distinct, but the fin-membrane between A, C and D^2 is still present. The number of rays in the 2 larvae are as follows:

D^1	D^2	A	P	
6 (7)	11 (12)	14	16	19 mm.
7	13	14	16	20 —

[1] Comparing the 5 larvae it is seen that the spines of the head are developed in the following order: occipital, then preopercular and lastly frontal and nasal spines.

As the fish grows, it is the preopercular spines which develop most, the occipital and frontal spines (especially the last) being more like elevations on the uneven surface of the head (ca. 120 m), until the fish has become adult and the four characteristic frontal "ornaments" are developed.

The colour of the larvae from 1907 was as follows. The anterior part of the body and (especially) the head were light greenish-gray above; a little in front of the beginning of the abdomen this colour changes to whitish yellow, which is continued to the end of the tail. The abdomen is brownish-red with a few grains of purple pigment. The gut silvery like the iris, which above has the black pigment of the upper side of the head. The pupil dark-blue. The whitish-colourless caudal region is iridescent with reflected light. The black pigment is in the form of large chromatophores collected in the occipital region and above the gut; a dorsal and anal streak (along D^1 and D^2 and A) of smaller (but yet distinct) chromatophores; the former are more distributed over the whole of the back and a little down the sides and are connected with the occipital pigment in front. A distinct lateral streak of oblong chromatophores passes from above the anus to the root of the tail; between this streak and the anal streak the connection is fainter than between the dorsal and lateral streaks. Fainter pigment on the gill-covers, snout, base of the pectorals and upper parts etc.

Of the larvae from 1908 the specimen of 10 mm has a similar pigmentation, whilst that of 20 mm certainly had the same characteristic pigment in the main (lateral, occipital, abdominal, dorsal and anal pigment), but the pigment of the gill-covers is now chiefly collected behind the eye and the dorsal pigment chiefly at the beginning and end of C, D^1 and D^2; further, there are now many and large chromatophores between the dorsal, lateral and anal pigment, as also on the abdomen. There is also pigment now on the tail-fin, connected with that at the caudal peduncle.

Specimens of ca. 150 mm are uniformly grayish-green with lighter belly, the back, sides and the fins (except the ventrals) being blackish-gray (weakest on the gill-covers and anal fin). Over this we sometimes notice (see adult) irregular, black shields. The ventrals are greenish-yellow, and neither the gill-covers nor the jaws have the red colour of the adult.

In the adults (over ca. 200 mm), of which I have taken a coloured sketch (from the living animal), the upper side of the head and the back are olive-green to brownish-black; the sides of the trunk and tail are more light greenish-yellow, grading through

bluish to the light-coloured belly. The last is whitish yellow, the under part of the tail more light-blue. When the fish is dead, a quantity of black pigment grains become prominent in the jugular region; they form a square open in front, and similar pigment is found (more sparsely) between the ventrals and between the latter and the pectorals. The ventrals are yellowish-red (with lighter tips), whilst the tips of the pectoral rays are light yellowish-brown, the pectorals being otherwise of the same colour as the back. The unpaired fins also have the colour of the back and the cross-bands occurring on the head and upper part are also continued on to the fins, though these cross-bands are very variable in appearance both in regard to form and extent, probably according to the surroundings (cf. *Salmo alpinus*). In the anal fin the first ray is a pale brownish-gray like the tips of the others.

Phobetor ventralis Cuv. et Val.

In Danmarks Havn and neighbouring waters this fish occurs in ca. 0—10 m. (littoral and Laminaria regions), like *Cottus scorpius*, which species it also seems to resemble in regard to abundance. Only 5 specimens in all have been taken, at the end of July 1907 in the harbour, in addition to 3 smaller specimens at Hvalrosodden 26.—8.—1906. To judge from the place of capture of the last, the young (not the pelagic stages but the older) occur in shallower water than the adults, but it is common to all that they occur on soft bottom (yet with some stones). Further south on the east coast[1] it is known from slightly greater depths (to ca. 30 m), thus from the Delesseria region also, but it is nevertheless a fish which is typical for the Laminaria region, in which its main distribution lies. With regard to the size and sex the 8 specimens arrange themselves as follows:

from Danmarks Havn ♀ 140 and 125 mm; ♂ 108, 107 and 68 mm
from Hvalrosodden 36, 26 and 25 mm

Of the 3 specimens from Hvalrosodden the two smallest are of a size (25—26 mm) which has hitherto not been known. The young of ca. 10—ca. 18 mm have been described by Ad. S. Jensen[2], Kofoed[3] and Ehrenbaum[4] but the stages between these and ca. 35 mm have not been known hitherto. My two specimens of 25 and 26 mm have distinctly separated, unpaired fins, the membrane connecting them

[1] Ad. S. Jensen l. c. p. 227.
[2] l. c. p. 238.
[3] Poissons (Croisière oceanographique de "Belgica" dans la mer du Grönland, 1905. Bruxelles 1909). p. 40.
[4] Nordisches Plankton. IV. Lieferung. Kiel und Leipzig 1905. I, S. 62.

having disappeared. In the larger specimens there is a marked sexual difference in the height of D^1 and length of V:

$$D^1 \begin{cases} 12 \text{ mm} \\ 11 \text{ —} \end{cases} \qquad V \begin{cases} 21 \text{ mm in ♂ of } 107 \text{ mm} \\ 20 \text{ — - ♀ - } 125 \text{ —} \end{cases}$$

At a length of 25 mm the preopercular spines are apparent, but the uppermost is not yet bifurcated; at 36 mm it is divided into two branches and at 68 mm there is an indication of a 3rd division. Among the larger specimens this spine has 2—3 branches in a ♀ of 140 mm, but 3—4 in a ♀ of 125 mm and ♂ of 105 mm. From a length of 68 mm onwards the upper side of the head has a number of roughnesses but no spines.

Regarding the colour of the living specimens I have the following observations (along with my coloured sketches).

Ca. 25 mm (Pl. XLVI, fig. 6). The belly and the anal and ventral fins are whitish; the head and back as also the sides have a grayish brown tone, with a large, dark-blue spot on the occipital region as also on the abdominal region behind the pectorals. Larger and smaller spots are also present under the two dorsal fins and there is especially a characteristic, lozenge-shaped marking (varying in form and extent) of dark-brown pigment from above the anus to the caudal fin (the beginning of the later so characteristic, festooned marking on the caudal region below the lateral line). The pectorals have pigment only on the base and the unpaired fins weaker pigmentation, which is also present behind the eye and between the occipital spot and the first dorsal.

Ca. 35 mm (Pl. XLVI, fig. 7). The later so characteristic festooned marking on the caudal region is now almost fully developed, the spots having fused together. Owing to the very dark-brown pigment dots on the dorsal region (the grayish-brown tone of the younger specimens) the occipital and abdominal spots and the spots under the two dorsal fins are less apparent than in the younger specimens (but are to be seen); the pigment under the eye has now collected into a larger spot. The most characteristic thing now, however, is the appearance of dark-brown cross-bands on the 2 dorsal fins, the caudal and pectoral fins, which later distinguish this fish. The belly is a lightish-yellow as also the anal and ventral fins.

Ca. 68 mm (Pl. XLV, fig. 9). This stage is different from the foregoing by the belly being more silvery (as also A and V); the cross-bands on the other fins are now more distinct and broad (especially on P and C). Of the large spots on the dorsal region only those under D^2 and on the caudal peduncle are now distinct, owing to the spreading of the brown ground-colour; but the caudal

region under the lateral line has a very characteristic festooned marking in the form of 3—4 crescents connected continuously with one another.

Over 100 mm the ground-colour of the dorsal region is still darker and has almost entirely blotted out the dark spots under D^2. The belly as well as the ventrals and anal are pale reddish-yellow in the male (which has a much stronger colour on the whole than the female), more pale silvery in the female. The festooned marking of the caudal region is now somewhat spread out (but yet distinct), as the spots are about to grade into the colour of the dorsal region. The cross-bands of the fins are now very distinct and almost blue-black; it is peculiar, that whilst a ♂ of 107 mm and a female of 140 mm have "sooty" colouration on the skin of D^1, this is wanting in a ♀ of 125 mm.

Triglops pingelii J. Reinh.

After *Gadus saida* and *Icelus hamatus* this was the fish most frequently taken at Danmarks Havn (and once in Stormbugt), where it is exceedingly common (especially smaller specimens of ca. 50—100 mm) in the soft bottom of the Laminaria and Delesseria regions (ca. 5—20 m), so that the adults mainly occur in deeper water than the young. Elsewhere on the east coast[1] it has been taken at a depth of 200—300 m, and we may conclude that it also occurs at intervening depths (ca. 20—200 m); but to judge from its abundance its main distribution is certainly in the two regions mentioned (in the deeper water also it has only been taken singly). A pelagic larva of 24 mm was taken in a depth of over ca. 10 m on 8.—10.—1906. All the other specimens are from July and August 1907.

Regarding the dimensions of the fish the table below shows that the largest ♂ measured 148 mm, the largest ♀ 155 mm. In these:

Length of P	Length of V	Height of D^1	
29 mm	19 mm	11 mm	♂ of 148 mm
28 —	18 —	11 —	♀ - 155 —

It will be seen that the sexual differences are chiefly shown in the length of the pectorals and ventrals (in addition to the size and colour markings).

In the female of 155 mm (which like all the other fish over 100 mm was taken on 25.—8.—07) the abdomen was swollen with fairly few but large, ripe eggs (ca. 3 mm in diameter), which were of a transparent, light-red colour.

[1] Ad. S. Jensen l. c. p. 247 and Kofoed l. c. p. 488.

mm	mm	mm	mm
155 ♀	1	87	53 ×××××
4	120 ♂ ♂	6	2 ×××
3	9 ♂	5 ♂	1 ×××××
2	8	4	50 ××××
1	7	3 ♂ ♀	9 ×
150	6	2 ♀♀♀	8 ××
9	5 ♀	1 ♂	7
8 ♂	4 ♀	80 ♀	6
7	3	9 ♂	5 ×
6	2	8	4
5	1	7 ♂ ♀	3
4	110	6 ♂	2
3 ♂	9	5 ♀	1
2	8 ♀	4 ♀	40
1	7	3 ♀♀	9
140 ♂	6	2	8
9 ♂	5 ♀	1	7
8	4	70	6
7	3	9	5
6	2	8	4
5	1	7	3
4	100 ♂ ♂	6 ×	2
3	9 ♂	5 ×	1
2	8	4 ×	30
1	7	3 ×	9
130	6	2	8
9	5	1	7
8	4	60 ×××	6
7	3	9 ×	5
6	2	8 ××××	4 ×
5	1	7 ×××	3
4	90 ♂	6 ××××	2
3	9	5 ××××××	1
2	8	4 ×××	20

The larva of 24 mm has 2 spines on the occipital region and indistinct rudiments of spines on the preoperculum. Further, the caudal fin is connected by a long rayless membrane with the dorsal and anal fins. The part of the caudal which lies in continuation of the peduncle has no rays; on the other hand, these are distinct in the remaining part of *C* as well as in *P*, *A* and *D*. The pectorals reach back to the anus (which lies 9 mm from the snout). The

dorsal fin has a concavity which indicates the later division between D^1 and D^2, and the ventrals are fairly distinct. The fin-ray formula is:

D^1	D^2	A	C	P
8 (9)	19 (20)	17 (18)	20 (21)	17

The colour of this larva (Pl. XLVI, fig. 8) is the following. The ground-colour is transparent silvery blue (especially on the head), the abdomen yellowish-white and the iris silvery. The black pigment covers the lower lateral parts of the head (especially the jaws and preoperculum) as also the peritoneum above the stomach and the occipital region; there is also a little on the base of the pectorals. Characteristic further are 1 pigment streak along the anal fin and two isolated pigment spots along the dorsal fin; also two spots at the end of the hypural bone and one above this. Lastly, there is fainter pigmentation evenly distributed on the head and the pectorals.

As will be seen, the pigmentation differs somewhat from that described earlier; that the specimen is a *Triglops pingelii*, however, is easily seen from the whole form of the fish, the length of D^2 and the relatively large ventrals, the pigment along the anal and on the jaws etc.

At a length of ca. 50 mm (Pl. XLVI, fig. 9) the species is readily distinguished (in addition to from its elongated, narrow form) from its black jaws, pigment spot on the gill-cover, large and small brown-black pigment dots on the abdomen and a characteristic pigment marking on the side of the trunk and tail (under the dorsal fin) in the form of isolated or connected, oblong spots. The rays of the pectorals and unpaired fins have dots of pigment.

At ca. 80 mm (Pl. XLIV, fig. 3) the jaws are blackest in the male. The characteristic marking on the sides of the fish are now changed to a slightly variable, but characteristic system of dorsal and medio-lateral spots (the first are the largest and most irregular, the last the most numerous), which are isolated or mutually connected in a characteristic manner. Several of the dorsal spots have disappeared in the brown ground-colour of the back and head; this also applies to the spot on the gill-cover. The pigment on the caudal fins is present mostly as a dark marginal band and that of the pectoral is in the form of ca. 4 curved cross-bands.

In the female of 155 mm (Pl. XLIV, fig. 1) the head and back have a reddish to dark-brown colour. The characteristic light spots on the side of the tail (produced by the fusion of the dark spots on the younger specimens) have the whitish-blue colour of the ventral aspect and are not (as in the male) distinctly marked off

from the dorsal colour. The latter is not (as in the male) sharply distinguished from the colour of the belly, which is silvery-yellowish; round the anus it is light-red, owing probably to the degree of development of the sexual organs. The brownish-red colour of the head also spreads out on the yellow iris without however (as in the male) completely concealing this. The gill-cover has the colour of the belly; behind it there is no large silvery and purple-red spot (in contrast to the male). Just as in the male the dark posterior margin of the caudal fin is broad and there is a great deal of dark pigment round the caudal peduncle; it is also common to both sexes, that the other fins only have pigment on the rays (in the form of spots), and that the dark dorsal colour of the caudal region is continued down on the light colour of the belly in the form of characteristic tongues.

A male of 148 mm (Pl. XLIV, fig. 2) is distinguished from the foregoing by the very black jaws, brownish-black head and back colour (which covers the most of the latter). The gill-cover is blue-black and there is a large silvery (and behind this a purple-red) spot at the base of the pectorals. The dorsal colour is distinctly marked off from the silvery belly, though it is continued (especially on the abdomen) down over the latter in the form of more or less broken, parallel tongues along the ribs. The caudal region has silvery spots (isolated patches of the colour of the belly), which are distinctly bounded by a blue-black ring and outside this by the colour of the dorsum (all the statements of the colour are based on observations and sketches of the living fish).

Icelus hamatus Kr.

Gadus saida and this species are the commonest fishes on the coasts of North-East Greenland, where they were taken in quantity in Danmarks Havn and neighbouring waters at a depth of ca. 2—40 m. Like *Triglops pingelii* it has a characteristic, bathymetric distribution with age, only the young (ca. 30—40 mm) occurring in the littoral region (soft bottom); both these and the somewhat older (up to ca. 80 mm) are met with in the Laminaria region; and in the Delesseria (or Lithotamnion) region we find only the very large specimens (over ca. 80 mm), but then both on the soft and hard bottom. Thus, though the young are in quantity one of the most typical fishes of the littoral region, the adults are much scarcer, even in their main region of distribution at a depth of ca. 10 m., but they nevertheless along with *Triglops pingelii* belong to the most abundant bottom fishes. The fish taken were caught in July—September 1906 and 1907; of these several (marked with (♀)

in the accompanying table) had almost ripe, but few eggs (1½—2 mm in diameter) in the ovary. As will be seen from the table, the females reach a much greater size (100 mm) than the males (70 m). The ♀ of 100 mm (Stormbugt 28.—8.—07) had the abdominal cavity, intestines, musculature etc. filled with diseased growths (*Myxosporidœ*), and the sexual organs were in consequence but slightly developed. The stomach of one specimen from St. 65 contained a prawn (*Hippolyte?*).

mm	mm	mm	mm
100 ♀	79	59	39 ×××××××
9	8	8	8 ××××
8	7 ♀	7 ♀	7 ××××
7	6 (♀)	6	6 ×××
6 ♀	5 ♀♀(♀)	5 ♀	5 ×××××
5 (♀)	4 (♀)	4 ♀	4 ××××
4	3	3 ♂	3 ××××××××
3	2	2 ♂	2 ××××××××
2	1	1 ♂♀♂	1 ×××××××××
1	70 ♂	50 ♂♂♂	30 ××××××××××××××
90 (♀) (♀)	9 ♂♂	9 ×	9 ××××××××
9	8 ♂♀	8 ×	8 ×××××
8	7	7 ××	7 ×
7	6 ♂	6	6
6	5	5 ××××××	5
5 (♀)	4 ♂♀	4 ×××××	4
4	3 ♀	3 ×××××××	3
3 ♀ (♀)	2	2 ××××	2
2	1 ♀	1 ×××××	1
1	60 ♀♂	40 ××××××××	20
80 (♀) (♀)			

As types of the colouration of the fish (from observations and sketches of the living fishes) we may take 2 sizes.

Ca. 30 mm (Pl. XLVI, fig. 10): The brown-black pigmentation is extremely characteristic, in the form namely of a bifurcated figure which surrounds the caudal peduncle and is continued forwards along the flanks of the caudal region, where (between D^2 and A) it breaks up into a number of mutually connected branches, which form a characteristic marking with the large spot behind D^1. Also characteristic is a spot at the base of the pectoral as also the broad, oblique stripes from the otocystic region to the gill-cover and jaws. Above the base of the pectoral there is a larger

spot, which however melts into the dark colour on the head and dorsum. With exception of *A* and *V* the fins have pigment on the rays in the form of spots.

At ca. 80 mm (Pl. XLV, fig. 8) and upwards the bifurcated figure on the caudal peduncle is no longer in connection with the marking of the tail; the latter differs from the previous stage in being completely broken up into rounded or branched spots (the first along D^2, the last along *A* and end of the tail). The oblique stripes from the eyes are now transformed to more irregular figures. The anal fin now has pigment spots like the other fins (except *V*).

Cyclopterus spinosus O. Fabr.

This species, which when older with *Liparis fabricii* Kr., *Careproctus reinhardti* Kr. and several *Lycodes* species composes the fish-fauna characteristic of the deeper layers (over ca. 50 m) in the fjords of North-East Greenland, has been taken on the Expedition both in Danmarks Havn and in the surrounding waters. At the former place, it is probably only the young which occur (the 5 taken measured 18—ca. 30 mm) and it seems as if there was a bathymetric distribution with age even among these, the youngest being taken in the Laminaria region, the older between this and the Delesseria (Lithotamnion) region or exclusively in the latter. Specimens of less than 18 mm were not taken on the Expedition but KOFOED[1] has found the fry of 11—16·5 mm in 0—7 m at Spitzbergen, which is in full agreement with my observations, and gives reason to conclude, that they also occur in the littoral region at North-East Greenland.

In spite of the many fishing experiments which were made in Danmarks Havn, only 5 *Cyclopterus* were taken; it is thus far from being among the common fishes, such as *Liparis liparis* not to mention *Icelus hamatus* and *Triglops pingelii.* — The larger specimens (over ca. 50 mm long) are not found in the shallow Danmarks Havn, but were taken in the surrounding waters (Stormbugt, Øresund) in deeper water (ca. 150 m). Sometimes (Maroussia 17/7 07 and Dovebugt July 1908) dead fish occur on the ice or in holes of melting water and ice; it is probably the pressure of the masses of water during the melting of the ice or currents in deep water which have brought them up from their natural habitat. When young they are found both on soft and hard bottom, attaching themselves by their sucker to the algae in the former for want of stones. Yet t h e h a r d k i n d o f b o t t o m i s t h e i r t r u e h a b i t a t and the larger specimens

[1] l. c. p. 5—6.

are found exclusively on this, being the most characteristic fish on this otherwise so poor region.

As soon as I put the young (ca. 25 mm) in a glass with water, they swam about vigorously in it (by means of rapid, wriggling movements of the tail) and then soon attached themselves to the sides by means of their sucker; here they could remain for a surprisingly long time. The young specimen of 18 mm was taken on 19.—9.—06, all the others in July and August 1907 and 1908; of these the 5 largest measured ca. 65, ca. 70, ca. 75, ca. 85 and 115 mm. A cluster of eggs of the size of an acorn (probably a piece of one much larger) was fished up in Danmarks Havn from 20—30 m (hard bottom) on 29.—8.—07.

In the external appearance of the fish the spinous equipment is most characteristic. As is known, it is extremely variable with regard to extension, development and time for its appearance. The condition in my specimens is as follows. At 18 mm the four nostrils are almost longer than the spines; the latter are best developed above and behind the eyes, as also under D^1 and D^2. The sides of the tail and abdomen are uneven from projecting spines. Rays are apparent in D^1, that is, not covered by the fold of skin which appears later; their points have no small shields, like *A*.

A specimen of 26 mm differs from the foregoing in that there is no indication of spines along the sides of the tail, whereas some small spines are present on the gill-cover. The dorsal spines are also found here, but have increased to a double row from above the eyes to below the anterior edge of D^2; there are ca. 8 scattered spines on the abdomen laterally; like the dorsal spines they are well-developed with several points. The rays of D^1 are now apparent, the margin of the fin is still without shields, like *A*; nor are there any spines between the sucker and the anal fin or on the forehead between the eyes.

A specimen of 27 mm differs from the above by the lateral region of the tail and the interorbital space having smaller or larger spines and by the abdominal spines being arranged in 2 parallel, curved rows from the gill-cover to the anus; further, from the sucker on both sides of the anus there is a row of spines which continues along *A*. The dorsal spines are as in the previous specimen, but now reach still farther back. The gill-cover likewise has small spines and of the D^1 rays (which are still apparent) the first 5 each have a small, shield-shaped spine at the tip.

At a length of ca. 70 mm we have a specimen which differs greatly in regard to spines from two others almost of the same size (ca. 65 and ca. 75 mm). All the spines are smaller and almost of

the same size; they form no distinct rows (except on the unpaired fins) but are scattered about irregularly. The spines of the head occur especially on the preoperculum and on the forehead; the spines of the body are much more developed in front of a line from the front edge of D^1 to the beginning of A than behind this line. There are spines at the base of D^2 and A, but not under D^1; the last is covered with a skin and has an outer, complete row of 5 large spines. There are no spines on P or inside (below) the two rows from the anus to A, as in the following.

The other 3 larger specimens (ca. 65, ca. 75, 115 mm) agree with each other in the spiny equipment, which is developed in the form of 6 rows of (mostly large) spines on each side, forming 4 rows on the forehead to the snout, a row of small spines under the eye and 2 rows of larger and smaller spines along the preoperculum. Further, there are small spines inside (below) the two abdominal keels, along D^2 and A and on P, in addition to the earlier mentioned, 5 small shields on the tips of the rays of D^1.

Comparing the above descriptions, we may perhaps draw the following conclusions; the dorsal spines are the earliest developed and most constant; next come the spines on the abdomen and lateral region of the tail, which however are generally larger and earlier present than the spines of the gill-cover and fins.

Regarding the colour of the fish I have observations and coloured sketches of 6 types. At 18 mm (Pl. XLIV, fig. 4) the two eyes are like the centres of a star of radiating, bluish-green stripes, which lose themselves backwards in the yellowish-brown ground-colour (on the head, trunk and tail), which alternates in the form of stars with the green stripes. The brown colour is darker on the trunk than on the head and still darker on the tail; it is in the form (especially dorsally) of dotted spots or patches, indicating tesselated marking (cf. the black and reddish-yellow colour of the adults on the back and sides). In the region of the tail this brown colour forms a characteristic marking, as it continues down on to the light ventral aspect as pointed tongues (most distinct between D^2 and A). P, D^2, C and A have brown and light-red spots on the outer margins, the sucker is of the same colour as the belly.

At 27 mm (Pl. XLIV, fig. 5) the radiating, green stripes of the eye are still more covered by the brown ground-colour (but can still be detected). The latter is still darker than in the above (especially the jaws, gill-cover, lateral aspect of the trunk) and the characteristic marking on the side of the caudal region is distinct. The ventral aspect is silvery and the sucker light-red; P has a large, triangular, yellow to whitish-blue spot at the base and a yellowish-

brown outer margin; the other fins (except D^1, which has the brown colour of the back) have light-red spots on a clear ground.

Liparis liparis L.

This species is common at depths of 5—20 m, that is in the Laminaria and Delesseria regions, especially in the former, with the algal vegetation of which its brown colour agrees excellently well. Even if it may also be met with on the hard bottom, it is found chiefly on the soft kind of soil, and both the small and large individuals occur there. The specimens taken are partly from Danmarks Havn, partly from the neighbouring waters, July-October 1906 and 07. The largest specimen measured 105 mm, the smallest was a larva 15 mm long. (19/9 06).

Curiously enough this fish has not hitherto been known from the east coast of Greenland north of ca. $65^1/_2$° N. L.[1]; the reason is perhaps, that the investigations were chiefly made in deeper water (yielding among others *Liparis fabricii* Kr.), and that the fish is far from being so common that every haul in shallower water will contain it (as I found at Danmarks Havn). That it occurs within the ca. 11° of latitude referred to, there can scarcely be any doubt; the specimens taken by me fill up the gap in its region of distribution between Ellesmere Land[2] and the North Polar Ocean[3].

Regarding the colour of the fish I may describe the following types on the basis of my observations and coloured sketches.

The pelagic larva of 15 mm (Pl. XLVI, fig. 1) has yellowish-white ground-colour on the head, trunk and tail as also on the unpaired fins; the region round the anus is reddish-brown, the iris is silvery with blue sheen. The unpaired fins are represented by a continuous membrane from above the eye to the anus. The black pigment is not specially strong (most developed on the forehead and nape) and is scattered over the fish (though not on the end of the tail); there is as yet no trace of the cross-bands which appear later on the caudal region.

At ca. 40 mm (Pl. XLV, fig. 5) the ground-colour is now more brownish-yellow and has also spread out on to the unpaired fins; the abdomen however is yellowish-blue and silvery, the upper part (intestines) dark-brown. The many red dots of pigment are characteristic, being present especially on the fins but also covering the back and sides. The black pigment is now present as shadows at

[1] Ad. S. Jensen l. c. p. 251.

[2] Ad. S. Jensen: Fishes (Report of the Norwegian Arctic Expedition 1898—1902. Nr. 25, p. 11.

[3] N. Knipowitsch: Zur Ichthyologie d. Eismeeres. p. 44. (Mem. Acad. Imp. Scien. St. Petersburg. Ser. VIII. Cl. Phys. Math. 1907. Vol. XVIII, Nr. 5).

the same places; the characteristic cross-bands are easily seen on the unpaired fins to a number of 5—10.

At ca. 90 mm and more the ground-colour is extremely characteristic and surprisingly constant in the different specimens. On the back and sides it has the dark-brown colour of the Laminaria. Below a (broad) line from the anus to the upper corner of the pectoral the abdomen is of a fine, dark, lemon-yellow colour and the lower side of the head is a light flesh colour (below a line from the corner of the gill-cover parallel with the free margin as far as the mouth and under the lower jaw). The root of the pectoral is brown like the trunk, the outer part like the unpaired fins and the ventral is light-red. The eye more golden than silvery, the pupil black. The dark caudal cross-bands are now very distinct on the fins, grading into the dark ground-colour on the caudal region.

Regarding the differences between *Liparis liparis* and *L. fabricii*, the pigmentation in *L. liparis* is very characteristic in the different stages, as shown above, and the same holds good for *L. fabricii* (see later). If we compare the 3 + 3 types described above of *L. liparis*, i. e. 15, ca. 40 and ca. 90 mm, in regard to colour with similar individuals of *L. fabricii* of ca. 20, ca. 50 and ca. 100 mm we obtain the following table.

	Liparis liparis 15 mm	*L. fabricii* ca. 20 mm
Ground-colour of trunk (also the unpaired fins)	yellow-white	colourless
Abdomen	blue	blue
The black pigment	evenly distributed on trunk and fins; none on end of tail	stronger than in the other species; also on the end of tail
Cross-bands in caudal region	wanting	wanting
Unpaired fins	colourless	colourless

	Liparis liparis ca. 40 mm	*L. fabricii* ca. 50 mm
Ground-colour of trunk	yellow-brown with red dots	colourless
Abdomen	silvery-blue and brown	silvery-blue
Black pigment present	as dorsal and lateral shadows and especially as 5—10 cross-bands on tail	evenly distributed, most developed on head and along base of D^1, disappearing behind; 5 dorsal and 4 anal cross-bands
Pectoral and unpaired fins	like ground-colour of trunk	colourless
Ventrals	light-red	do.

	Liparis liparis ca. 90 mm	*L. fabricii* ca. 100 mm
Ground-colour of trunk	brownish-yellow	colourless with violet-brown shade
Abdomen	lemon-yellow	dark blue
Unpaired fins	red-striped	colourless
Pectorals	brownish-yellow and light-red	do.
Ventrals	light-red	do.
Black pigment	as at ca. 40 mm; the 5—10 cross-bands most distinct on fins	as at ca. 50 mm (gill-cover, pores of head, lower $^{2}/_{3}$ rds of P, underside of belly and tail, and *D* and *A* between the cross-bands without pigment)

With regard to the outer form of the two species we have the following differences:

	Liparis liparis 15 mm	*L. fabricii* 21 mm
Upper part of head (forehead)	hollow	convex
Dorsal membrane begins	over eye	over hind-edge of gill-cover
D and *A*	slightly high in middle	not specially high in middle
Caudal fin	rounded behind	rounded behind
Length of head	4 mm	4·5 mm
Length of *P*	2·5 —	3 —
Greatest height of body	3·5 —	4 —
Snout to anus	5·5 —	6·5 —
Diameter of eye	0·8 —	1·3 —

	Liparis liparis 42 mm	*L. fabricii* 48 mm
Upper part of head	flat	convex
Beginning of *D*	over middle of abdomen	over hind margin of gill-cover
D and *A*	high in the middle	not specially high in middle
Caudal fin	distinct from *D* and *A* and hind margin rounded	joined with *D* and *A* and posterior margin rounded
Length of head	11 mm	11 mm
Length of P	8 —	7 —
Greatest height of body	9 —	9·5 —
Snout to anus	15 —	15 —
Diameter of eye	2 —	3 —

	Liparis liparis 105 mm	*L. fabricii* 115 mm
Upper part of head	flat	convex
D begins	over middle of abdomen	over hind-margin of gill-cover
D and *A*	very high in the middle	not specially
C	distinct from *D* and *A*	joined with *D* and *A*
Posterior edge of *C*	rounded	more square
Length of head	25·5 mm	25 mm
Length of *P*	20 —	17 —
Greatest hight of body	21 —	23 —
Snout to anus	35 —	32 —
Diameter of eye	4 —	6·5 —

It will be seen from the above, that the difference between the 2 species lies, inter alia, in the distance between snout and anus, which is greatest in *L. liparis* ($\frac{1}{2-3}$ of total length) and least in *L. fabricii* ($\frac{1}{3-4}$ of total length); further, in the diameter of the eye, which is greatest in *L. fabricii* (less than 1/19 of total length) least in *L. liparis* (over 1/19 of total length); lastly, the height of the body is a little greater in *L. fabricii* than in *L. liparis.*

Liparis fabricii Kr.

This species seems to have its main distribution in depths over ca. 50 m (hard and soft bottom). I have only taken it on the following occasions:

21 mm (Pl. XLVI, fig. 2) 11.—10.—06. Danmarks Havn. 10—15 m hard bottom.

48 mm (Pl. XLVI, fig. 3) 24.—8.—07. Stormbugt. ca. 100 m hard bottom.

115 mm (Pl. XLVI, fig. 4) 22.—7.—08. 77° N.L., $18^{1}/_{2}$° W.L. ca. 300 m gravel and mud.

2 somewhat damaged *L. fabricii* (ca. 145 and ca. 105 mm) were found at a channel in the ice off Maroussia Island. 17.—7.—07. Depth of water at the place 150 m, gravelly bottom.

On earlier expeditions, however, it has been taken further south on the east coast[1] in sufficient numbers to show, that it is a common and typical fish in the greater depths.

Regarding the colour and form of the fish, the contrast to *L. liparis* has been shown in the 6 tables above, from which it will

[1] AD. S. JENSEN l. c. p. 252.

be seen, that the ground-colour is pale and the black pigment stronger and more distributed than in *L. liparis.* At a size of ca. 50 mm the pigment is mainly arranged along the dorsum of the fish and the black cross-bands distinct. At a length of ca. 100 mm the main impression of the colour is gray-blue, the black pigment partially covering the violet colour below, which is more light-red on the fins. The blue colour of the abdomen is now also much less distinct from that of the trunk, grading evenly over into that of the latter.

Careproctus reinhardti Kr.

Of this species only two young specimens (25 and 27 mm) have been taken near Lille Koldewey Island (76°15′ N. L., 18°26′ W. L.). The depth was 150 m, the bottom-soil clay with many stones and a few red algae. Elsewhere on the east coast it has been taken by Kolthoff[1] at 200—300 m and Kofoed[2] has taken a specimen of 44 mm in 300 m. It thus belongs to the fishes which are typical for the great depths; the young live perhaps in shallower water than the adults.

My two specimens were somewhat damaged by the stones on hauling in; by means of the large head, the short trunk, small sucker far forward and the very long, narrow tail, they were, however, easily distinguished from the two *Liparis* species. The following measurements were taken.

Total length	Head	Jaw to anus	Jaw to sucker	Diameter of *V*	Diameter of eye	Greatest height	Greatest thickness	Height behind anus
27 mm	5 mm	6 mm	2·5 mm	3 mm	1·3 mm	5 mm	4 mm	2 mm

In colour the specimens were pale yellowish-white with a little indistinct dark-brown pigment, which was evenly distributed over the head, trunk and tail (yet not on the fins); there is a great deal especially on the forehead, pectoral region and at the base of the unpaired fins (Pl. XLVI, fig. 5).

Lycodes reticulatus Reinh. var. **macrocephalus** Jensen.

This characteristic Lycodes has only twice been taken, namely 1 specimen in Stormbugt 9.—9.—07 at a depth of 20—40 m (Lithothamnion region; hard bottom) and 3 specimens at the same place on 20.—8.—07 at a depth of 10—20 m (Laminaria region; soft bottom).

[1] Ad. S. Jensen p. 255.
[2] l. c. p. 6.

The first measured 75 mm, the others 38, 45 and 46 mm. Elsewhere on the east coast this species is only known as adult and from deeper water (Nathorst and Kolthoff; specimens of 61—245 mm from 100—300 m)[1]; and it thus seems as if the young occurred in much shallower water than the adults — a condition which also agrees with what is known from Spitzbergen.

Regarding the pigmentation of the fish in the living condition I have made one coloured sketch and the following observations (Pl. XLV, fig. 4). Dark spots form cross-bands against the light ground-colour; the spots are a shade darker than the ground-colour in their centre; the margin is darker brown and the continuations on the unpaired fins have a blue-black sheen. The pectorals and ventrals as well as the unpaired fins are yellowish with light-red stripes (especially posteriorly). The belly and under side of the head are silvery; the iris golden with blue-black outer margin and pupil.

Gymnelis viridis Fabr.

I have taken this species in Stormbugt and Danmarks Havn now and then in July—October 1906 and 07. It occurs here from ca. 10—ca. 40 m (Laminaria and Delesseria region) mainly on soft bottom. Its main distribution is in the Delesseria region, being the typical fish of this region, though much fewer in numbers than *Icelus hamatus* and *Triglops pingelii*. Of the ca. 25 specimens taken the smallest measured 54 mm, the largest 140 mm and it seems as if the bathymetric distribution according to age is less marked here than in most of the fishes already mentioned. Elsewhere it has been taken down to 100 m[2]; it is thus a species which is characteristic for not very deep water.

In a female of 108 mm (Danmarks Havn. 4.—9.—07. 20—30 m; soft bottom) the abdomen was swollen from a few (ca. 5) very large eggs (4 mm in diameter), which had a light-yellow colour.

The colour in this species is extremely variable, as is well-known; thus, among my ca. 25 specimens I have not found 2 which were exactly alike. Characteristic for them all is, however, that they assume to a high degree the colour of their surroundings (red algae); along with *Cottus quadricornis* and *Liparis liparis* this fish presents the finest examples of protective colouration according to their respective habitats (namely, littoral, Laminaria and Delesseria regions). Comparing all the specimens taken by me, I may make the following general remarks, based on coloured sketches and personal observations.

[1] Ad. S. Jensen l. c. p. 259.
[2] Ad. S. Jensen l. c. p. 264.

At a length of ca. 50 mm the dorsum is uniformly brown-gray-yellow, the belly and the fins lighter to quite white. At ca. 70 mm (Pl. XLV, fig. 1) there are alternating darker and lighter cross-bands, fusing anteriorly into the dark-brown ground-colour of the head and posteriorly into the light-brown of the tail. The cross-bands are continued out on to the dorsal fin. The outer part of the pectorals may now be bluish-brown and the anal fin often has a blue-black outer margin (in the first 2/3rds of its length). Specimens over ca. 100 m (Pl. XLV, fig. 3) have the back and sides a leather-brown to light reddish-brown ground-colour, whilst the ventral aspect is lighter to almost skin-coloured. The light cross-bands are sometimes not clear, being broken up into whitish spots (Pl. XLV, fig. 2) (dark dots appear, often united with characteristic markings in them), so that the dark cross-bands grade evenly into them. The ground-colour may be so dark, that the light cross-bands cannot be distinguished in front, or only indistinctly, and not at all posteriorly, or the bands may be very narrow and few. Both the light and dark cross-bands are continued out on to the dorsal fin, where they often form narrower or broader, quite white stripes; the last sometimes enclose one or several dark-blue spots, producing "eyes" of varying size and form; they are situated in the front half of the dorsal fin at different places in different fishes. The blue-black pigment on the outer margin of the anal fin may be more or less distinct and connected, longer or shorter; sometimes it is quite wanting.

Gadus saida Lep.

This species is exceedingly common both in the drift-ice off the north-east coast of Greenland and in the waters investigated round about Danmarks Havn. At the latter it was the most abundant fish, occurring at sizes of ca. 50 to ca. 150 mm in swarms in the upper layers in July—September, seeking their food among the icebergs. In among the drift-ice and off the coast I have only taken a few specimens of the size mentioned (one ♀ of ca. 140 mm at 75°55′ N.L., 14°35′ W.L. 8.—8.—06, also the otoliths and bones of others from the stomach of different birds (especially Larus eburneus) at about the same time. Two ♀ of ca. 100 and ca. 125 mm were taken on 22.—7.—08 at 77° N.L., 18½° W.L. 300 m). Very large specimens (over ca. 200 mm) seem to occur more singly (Stormbugt May—June 1907—08). Lastly, a tiny larva of 9 mm was taken in Stormbugt on 19.—6.—08 at a depth of 0—75 m (depth 207 m); along with the earlier known[1] larvae (of 13·5 and 16 mm) taken in Hurry Inlet at

[1] Ad. S. Jensen l. c. p. 269.

the beach and the larvae of 6½—11 mm described by JOHS. SCHMIDT[1] from Cape North in Iceland, it is one of the few specimens known of the *Gadus saida* larvae.

The table below shows the lengths in mm of the specimens taken; it will be seen, that most are grouped at a size of from 50—80 mm, though the number of specimens measured is only a portion of the total taken.

100 ××	7	74 ×	1 ××
9	6	3 ××	60 ×××××××
8	5 ×	2 ××××	9 ×
7	4	1 ××××××	8 ×××
6	3 ×	70 ×××××	7 ××
5	2 ×	9 ×	6
4 ×	1 ×	8 ××××××	5 ××
3	80 ×	7 ××××	4 ×
2	9 ×	6 ×××	3 ××
1 ×	8 ××	5 ××××××××××	2 ×
90	7 ××	4 ×××××××	1
9	6	3 ×××××	50 ×
8	75 ××××	2 ××××××	

310 ♀ 20.—6.—07	140 ♀ 8.—8.—06	120 ♂ 24.—7.—07
295 ♀ 31.—5.—08	133 ♀ 18.—7.—07	115 ♂ do.
290 ♂ do.	125 ♀ 22.—7.—08	107 ♂ 18.—7.—07
285 ♂ do.	120 ♀ 18.—7.—07	100 ♀ 22.—7.—08

The following table shows the sex of the specimens taken over ca. 100 mm; in the larger fish the length of the ventrals affords an excellent means of distinguishing between the females and males.

Total length	*V* measured from base to tip of longest ray
310 mm	50 mm (♀)
295 —	47 — (♀)
290 —	80 — (♂)
285 —	75 — (♂)

None of these 4 fish had the sexual organs so far developed, that spawning could be regarded as near at hand (greatest length of ovary ca. 60 mm and diameter of egg 1 mm).

With regard to the food of the species, the stomachs in July 1907 of specimens ca. 50—ca. 150 mm contained exclusively Crustacea

[1] De atlantiske Torskearters (Gadus-Slægtens) pelagiske Yngel. Kbhvn. 1905 (Meddel. fra Komm. for Havunders. Serie Fiskeri I. Nr. 4. p. 25).

(especially *Mysis oculata*), whilst 2 of the largest contained a reddish-yellow mass (*Calanus*) and whitish slime, a third *Mysis oculata* and 1 large Amphipod; a female of 125 mm and another female of ca. 100 mm had, in addition to slime, 1 of the large, red Copepoda from deep water. Lastly, the female of 310 mm had numerous Nematodes ca. 30 mm long, in the stomach and a rich "collection" of yellowish-brown parasitic Crustacea (*Antholca* (?)) in the mouth and on the gills.

This fish itself serves as food for seals (all the 4 largest were taken at seal holes on the ice and some have marks of the teeth of *Phoca foetida*), for birds (*Larus eburneus*) and for other, larger fish (2 *Gadus saida* of ca. 50 and ca. 100 mm were found in the stomach of a *Salmo alpinus*, 590 mm long, taken off the large river at Hvalrosodden 7.—8.—07).

With regard to the colouration of the species at different ages I have coloured sketches and observations of the following from life.

The larva of 9 mm has the black pigment in the form of large stellate spots partly over the abdomen, partly in the occipital region and on the sides in from the later place of the two dorsal and anal fins; lastly there is a little on the gill-cover. From the larvae described by Schmidt[1] of corresponding size this larva differs by the entire absence of pigment on the side down from the later position of the first dorsal fin (D^1); further, the pigment D^3 and A^2 are of equal length behind, whilst in front D^3 reaches much farther forward than A^2. Between D^2 and A^1 and between D^3 and A^2 there is a mediolateral streak of well-developed pigment grains and between D^2 and the occipital pigment there is a distinct gap (though there are a few dots of pigment between them and between D^2 and D^3).

At ca. 75 mm the iris is altogether silvery, the dorsum light-brown, the gill-cover and belly silvery; over the whole dots of brown-black pigment; outside and along the margin of the caudal peduncle a red streak.

At ca. 140 mm the dorsum is now more greenish than in the foregoing; the silvery colour on the gill-cover and belly very strong, weaker on the lower part of the tail.

At ca. 300 mm the pupil is blue-black; the iris black in the outer margin, towards the pupil changing to brown and from there to golden-yellow on the inner margin. From the lower edge of the maxilla to the gill-cover golden and shiny, ventral aspect of the mandible gray-brown, upper part of the gill-cover blackish brown

[1] l. c. Pl. I, figs. 19—23.

as also its lower and upper edge. Above a line from the horizontal diameter of the eye a little above the base of the pectorals to the lower base of the caudal fin the ground-colour is black-brown; lower down it is silvery with black dots, which however nowhere conceal the under-colour and are fewest from the base of the ventrals to the anus. The ground-colour of the mouth is whitish-blue; this and the throat have a dense collection of dark-gray dots at the places where there are skeletal parts and a little round about; these dots of pigment are also present on the gill-arches, especially on their upper side, less on the silvery lower side. The inner side of the gill-cover silvery-golden (the latter especially on the upper part) with black dots; the gills pale-red-lilac. All the fins are blackish-brown; the pectoral and anal fins have the colour of the belly at their base (though more whitish-blue than silvery), farther out the colour changes to blackish-brown. The peritoneum silvery with black pigment.

Salmo alpinus L.

This species is very common in every large lake (that is, which does not dry up in summer). That the fish may also live, however, in lakes with salt bottom-water is shown by its capture in Sælsøen[1] and in the outlet to this (the large river) behind Hvalrosodden. This place is also the only one, where a migration from the lake to the sea (July) and from the latter to the lake (September) has been observed with certainty; many of the other lakes in which the fish was found, probably have too small an outlet to allow it to pass through or return again, before the outlet dries up or becomes frozen over. A few smaller fish were seen however in the harbour in July 1907 and one taken up in the lake above the same place almost at the same time contained in its stomach one of the common, marine-littoral Amphipods, which shows that it must have been out in the salt water.

In winter the fish is seen under the ice, where it does not go down to the bottom (harbour, September—October 1906); they are very active and the large especially are very greedy (capture of a ♂ of 416 mm on 22.—9.—06 on lines); it is not until June however that sufficient ice is melted near the shore and the fish seen there in the open water (Gaasesøen 1907 and harbour 1908).

In the summers of 1906, 1907 and 1908 I had excellent opportunities of observing the migration of this fish from the lake to the sea and back again, namely at Sælsøen behind Hvalrosodden. At

[1] Regarding the natural conditions of this lake see my paper: "Freshwater Life etc.". Medd. om Grönland, XLV.

the end of June already ice-free water is present along the banks of the lake and though there is a teeming life here of *Apus glacialis* and other Entomostraca, larvae of flies etc., I saw no trace of *Salmo alpinus*; at this time however it was often seen making rings at the surface when snapping after food in the smaller lakes where it lives. It is only in the beginning of July that the open water has spread out so far in the lake, that the large fish (which in winter must be considered to live in deeper water) can come into the banks and I now often saw them strike up in the water, especially near where the river leaves the lake. As soon as the outlet began to melt I set out nets across it, without getting any fish however in the first few days; but as soon as the water began to flow (4—5/7) down the river to the sea, I obtained a number of fish in the net. At this time and from now onwards I saw nothing of the fish in the lake as before; probably because they are no longer compelled to stay about the outlet but can continue their migration out into the sea. Later in the summer the best fishing-place was at the outlet of the river into the sea; and so numerous were the fish, that as many as 50—100 could be taken in one net in one day. In August the migration was at its maximum and in September it was mainly in the direction from the sea up into the lake, until it ended when the river began to freeze over in the middle of the month. The smallest specimen I have seen was 20—25 mm, which was taken in the stomach of a fish ca. 600 mm long (Hvalrosodden, Aug. 1907); though much decomposed it was easily recognized from the large, round head, large eyes and the appearance of the occipital and dorsal pigment. More important however was the capture of a young specimen 30 mm long (probably the young of the year) by the bank of the lake above the harbour on 29.—7.—07. From this size and upwards to ca. 200 mm it is extremely common in shoals of 5—10, swimming about in the shallow water by the bank and (especially at night) striking up after the flies. Above ca. 200 mm the fish seem to go about more singly, except when the period of migration sets in (see above). The largest fish taken measured 700 mm.

The following table, which refers to some of the fish measured, shows the size and sex.

males: 700, 690, 680, 670, 660, 650, 645, 565, 550, 510,
490, 440, 416, 185, 170, 150, 120, and 110 mm.

females: 625, 520, 180, 178, and 157 mm

Regarding the spawning-time I have no certain observations; the many large males which were taken in July and August had the testes in various degrees of development, but none had running

milt; and of the 3 females taken at the same time 2 had small eggs (ca. 1·5 mm) in the ovary, whilst a female of 625 mm had numerous loose eegs (ca. 5 mm in diameter) in the abdominal cavity; these were damaged, however, the yolk having run out (the fish was dead when taken in the net); a few eggs of the same size were present in the ovary, which however chiefly contained much smaller eggs. This was probably an abnormal condition; to judge from the capture of a ♂ of 416 mm (22.—9.—06) which had the characteristic features of the spawning time (hooked jaws, strong colours), the deposition of the eggs probably takes place in the autumn.

One of the large fish taken in July 1908 (a male of 645 mm) had the characteristic monstrosity "pug-dog head" (short snout and upper jaw), which is described and figured by SMITT[1] in *Salmo salar*.

On examining the contents of the stomach of the specimens taken I have found, that the smaller (ca. 100—ca. 200 mm) contained mud from the bottom of the lake, but especially a quantity of larvæ, puppæ and imagines of flies (*Chironomus*). Several of the large specimens (over ca. 400 mm) had small fish in the stomach, partly of the same specimens (22.—9.—06, July 1908), partly *Gadus saida* fry (July 1907); further larvae of flies, Entomostraca and green algae. It should also be mentioned, that these large fish often had Cestodes in the intestinal fluids and various parasites (Nematodes for example) in the wall of the intestines; a specimen ca. 170 mm long was found dead on 20.—7.—07, obviously killed by the many parasites.

As is well-known this fish serves as food for the North-East Greenland Loon (*Colymbus septentrionalis*), from whose presence in summer in the different lakes we can often conclude as to the presence or absence of the sea-trout; it is also this fish probably which entices the fjord-seal (*Phoca foetida*) in to the river-mouths (where they are often seen for hours at a time) at the period when the ice breaks up here and the migration of the fish begins (Hvalrosodden July 1907).

With regard to the colour of the fish, without framing varieties or entering into a discussion of their value by comparison of my specimens with those earlier known, I shall only describe what I am certain about, on the basis of personal observation and coloured sketches of the living fish.

The young fish of 30 mm (Pl. XLV, fig. 7) still had to some extent a larval appearance, the membrane of the caudal fin being continued almost round to D^2 and A. The dark cross-bands are

[1] Skandinaviens Fiskar. Stockholm 1895. II Del. P. 854, fig. 213.

specially marked on the flanks of the tail (though not so much as later), the head, and dorsal and lateral parts of the trunk being covered by dark-brown pigment. The ventral aspect was yellowish-silvery and the fins yellowish-white.

At ca. 80 mm (Pl. XLV, fig. 6) the ground-colour differs from the foregoing by being lighter brown on the back and sides, with the result that the dark cross-bands (almost black-green) are all the more marked (this is already the case at ca. 50 mm). The ventral aspect is now more purely silvery and the fins are of a fine, yellowish-red colour, more or less sprinkled with black dots of pigment, which form a dark band on the outer edge of the caudal fin. This colour agrees well in tone with that of the lake-bottom and (in contrast to the colour of the older individuals) is surprisingly durable after the death of the fish or preservation.

At a size of ca. 100 mm the colour of the fish changes, the dark-brown or blackish-green colour of the back changing to a light-brown with dark cross-bands and a quantity of small, light dots on the sides of the fish. The ground-colour is now silvery-golden, with a blackish-brown layer of pigment over it, darkest on the dorsum and represented on the sides by ca. 10 cross-bands; the latter are mutually connected over the dorsum in pairs. The light-coloured spots on the sides are the ground-colour shining through and they are most numerous and largest round about the lateral line. The ground-colour of the dorsum is light earthy brown; and on regarding the fish from above, this colour is seen in the form of two oval spots in the occipital region and as a larger, broad streak (largest in front and rounded in form), which extends from above the pectorals to D^1; the connections of the cross-bands are seen in it. The gill-cover has a strong golden sheen and the black-brown pigment of the head covers especially the region behind the preoperculum and below the eye, where it is connected with the dark snout. The posterior margin of the maxillary is strongly pigmented and a little, scattered, black pigment is present in the cavity of the mouth. The ventral aspect from the tip of the under-jaw (which has a little pigment) to the anus is quite white. The iris is silvery with brownish-black pigment, the pupil black. The peritoneum is light-yellow. Of the fins P, D^1 and D^2 have black pigment (the first however only from a little in front of the middle and the uppermost ray); the other two gray with black outer margin. C has black pigment especially round about the base and the rays as well as along the outer margin. V and A only have a little black pigment along the rays. C, P and V have an orange-red ground-colour (on C however only to be seen as two, broad streaks on the outermost rays); P

and *V* have the red colour most marked along the innermost (shortest) rays, fading and changing to golden outwards; furthest out (anteriorly) the red colour is wanting, being replaced by whitish-blue (especially on *V*).

In fish of this size the colour changes as soon as the fish dies, the dark cross-bands disappearing almost entirely; the colour of the fins however is surprisingly durable. Sometimes we find specimens on which at various places (head, D^2 and *C*) there are coal-black shadowy spots — a feature which has been mentioned earlier (see *Cottus quadricornis*) and becomes still more apparent in the larger fish (see these).

The change in colour in the fish from ca. 150—ca. 400 mm is now seen especially in the fins, on which the pigment becomes stronger and more definitely bounded (the white margin on the outer margin of *V* and lower margin of *A* becomes very distinct and broad); further, the dark cross-bands of the trunk and tail are now absorbed in the olive-green-brown to bluish-gray ground-colour; on the other hand, the light spots on the sides are now larger, more numerous and redder than in the younger individuals.

In fish over ca. 400 mm there are two colour varieties.

In the first the dorsum is metallic greenish-blue to grayish-black with an even transition to the silvery flesh-coloured side; the latter colour changes through lilac tones to the white colour of the belly; on the sides of the fish and on *C* there are many larger and smaller, light yellowish-red spots at a distance of ca. 2 cm from one another and arranged in several longitudinal rows. Under a line from the base of *P* to the base of the lowermost (outermost) caudal ray there are no spots; the largest of these are situated round about the lateral line, but there is no regularity in their number. Of the fins D^1 has the colour of the dorsum mixed with whitish-gray (the latter colour is specially distinct on the front margin); posteriorly the colour changes to yellowish-red. D^2 almost as the foregoing. *C* also has the colour of the dorsum with whitish-blue outer margins above and below; but the two outermost rays above and below are yellowish-red. A has a white anterior margin, dark central part and red posterior and upper margin; *V* like the foregoing (outer margin = anterior, inner margin = posterior), *P* like D^1 (outer margin = anterior; inner margin = posterior); but the upper side was considerably darker than the under side (the same applies to *V*). Cavity of the mouth black between palate and upper jaw, otherwise white.

The second variety differs from the foregoing in that the dorsum is olive-green to green and especially in that the sides and belly are

coloured a beautiful orange; further, the throat is almost quite black and the colour of the fins described above is much stronger than in the first variety. Described in more detail the dorsum, the head (top and sides) and the flank (to some distance under the lateral line in the posterior third of the body and anteriorly to the under margin of *P*) are grayish-brown to olive-green; above *V* the colour of the belly forms a longitudinal belt 2 cm broad from a little in front of *V* to just above the hindmost point of the *V* rays and connects posteriorly by 5 stripes with the colour of the belly. The latter is strongly orange-yellow, lighter under the neck and somewhat in front of *V* (lower side of the fish); posteriorly the colour extends ca. 30 mm out on *C* near the lower margin of this fin; anteriorly the colour ends just under the preoperculum; ca. 10 mm in front of this there is an isolated yellow spot, and from here to the point of the lower jaw the blackish-brown colour is broken up into dots and shades on the white ground. The point of the lower jaw is black; posteriorly (along the walls of the mouth) it becomes brownish-yellow and its innermost half is bluish above, white below; these 3 colours are shaded with black. The anterior margin of the upper jaw is brownish-yellow, posteriorly black, as also the symphysis. The skin between the jaws and gill-cover white with a black shade and light shields are seen on the brownish gill-cover. The pupil bluish-black, iris silvery, covered with brownish-black pigment. Upper side and middle of *P* black, outer margin and under side whitish-blue with black shaded stripes, which follow the rays or the interspaces between these; the inner margin flesh-red and the tip reddish yellow-brown; from the root out 20 mm on the fin there is a yellowish-brown spot, which breaks up in front into a couple of smaller spots. *V* is of similar colour, but less black and more red flesh-coloured (the last in the innermost 2/3rds of the fins); *A* almost just as black as *P*, but only has the outer margin bluish-white (otherwise red flesh-coloured); the outer margin of *C* is bluish-white, otherwise like the colour of the dorsum. D^1 black with light anterior margin and whitish-blue colour as on P, posteriorly reddish-yellow; D^2 reddish-black. The sides of the fish with whitish-yellow (uppermost) to orange-red (innermost) dots or spots; on the anterior half of the body they begin 30 cm above the base of *P* and are present in 3—4 rows under the lateral line; in the posterior half they are considerably smaller and are present above the lateral line in 2 rows.

It may be mentioned, that the colours of the first variety are but little constant, the dark colour of the dorsum disappearing when the dead fish lies in water, changing from metallic to grayish-white; the colour of the belly also becomes paler, but the spots

rather become more marked. Some of the specimens taken had a darker dorsum than others, and this colour was often restricted to definite spots of the fish (head, fins etc.) in the form of shields, probably caused by the colours of the surroundings (cf. specimens of ca. 150 mm). On the other hand, the colours of the second variety were surprisingly constant, the more so the better marked they were (least in summer, most in autumn).

All the large fish of the first variety were caught during or just before the migration from Sælsøen through the large river to the sea (Dovebugt); most were males, a few females (see table); in addition to these and the same place and time (Aug.—Sept., 1906 and 1907 and July 1908) quite a few (all males) were taken of the second variety; but their colour was much less well-marked than that of the male of 416 mm taken in a hole in the ice of the lake at the harbour on 22.—9.—06. From this and from what has been stated earlier (under the discussion of the sexual conditions) I conclude, that the phenomena described by SMITT[1] hold good for the *Salmo alpinus* of North-East Greenland, namely, that the colour outside the spawning-time (spring and early summer) is that of the first variety (thus pale); when migration to the sea begins in July, the colouration gradually changes to that of the second variety (well-marked colours in the male, less so in the female), but the majority of the fish which live in the sea during the ca. 2 months (ca. 10 July—ca. 10. Sept.) still retain the pale silvery and metallic colour; when they again enter the freshwater in September they have all assumed the strong colours of the spawning time, and in the late months of autumn (November) the colouration of the fish is at its highest point, gradually fading towards the beginning of the year. It has to be remembered, however, as already stated, that the migration to the sea cannot on the whole be undertaken from all the lakes; where this does not occur, the fish can hardly assume the pale, silvery dress at any time, but retain throughout the year the blackish-green or orange-red dress, even though this may naturally be strongest in colour in the autumn.

Bones of *Salmo alpinus* have been found in the Eskimo ruins (meat-stores and tent-rings) at the earlier fishing-place near the outlet of the large river from Sælsøen to Hvalrosodden.

Conclusion.

Summing up the data given above on the biology of the various species of fishes, and making use of earlier observations, we obtain the following tables.

[1] l. c. p. 836.

Freshwater form	Saltwater forms
Salmo alpinus L.	Cottus scorpius, C. quadricornis, Phobetor ventralis, Icelus hamatus, Triglops pingelii, Cyclopterus spinosus, Liparis liparis, L. fabricii, Careproctus reinhardti, Lycodes reticulatus, Gymnelis viridis, Gadus saida, (Salmo alpinus).

Demersal eggs	Pelagic eggs
(Salmo alpinus), Cottus scorpius, C. quadricornis, Phobetor ventralis, Icelus hamatus, Triglops pingelii, Cyclopterus spinosus, Liparis liparis, L. fabricii, Careproctus reinhardti, Lycodes reticulatus, Gymnelis viridis.	(Gadus saida)

Occurrence of the pelagic larvae (not all the stages are known of all the species mentioned)

Littoral region	Laminaria and Delesseria region	Hydroid region
Cyclopterus spinosus	Icelus hamatus	Careproctus reinhardti
Liparis liparis	Triglops pingelii	
— fabricii	Gadus saida	
Cottus scorpius	Liparis liparis	
— quadricornis	— fabricii	
Phobetor ventralis	Cyclopterus spinosus	
Triglops pingelii	Lycodes reticulatus (?)	
Gadus saida	Gymnelis viridis	

Occurrence of the postlarval fishes (the species in spaced type are characteristic for the region)

Littoral region	Laminaria region	Delesseria or Hydroid region	Over 100 m (coral, mud or sand bottom)
C. quadricornis	C. scorpius	I. hamatus	C. spinosus
I. hamatus (young)	C. quadricornis	T. pingelii	L. fabricii
P. ventralis —	L. liparis	P. ventralis	L. reticulatus
L. liparis	P. ventralis	C. spinosus	C. reinhardti
C. scorpius	I. hamatus	G. viridis	T. pingelii
T. pingelii (young)	T. pingelii	L. reticulatus	
C. spinosus —	(G. viridis)	L. fabricii	
	L. reticulatus (young)		
	C. spinosus (young)		
	L. fabricii (young)		

Plate XLIV.

PLATE XLIV.

Fig. 1.	*Triglops pingelii* ♀.	155 mm.	$^1/_1$.
— 2.	— — ♂.	148 mm.	$^1/_1$.
— 3.	— —	77 mm.	$^1/_1$.
— 4.	*Cyclopterus spinosus.*	18 mm.	$^2/_1$.
— 5.	— —	27 mm.	$^2/_1$.

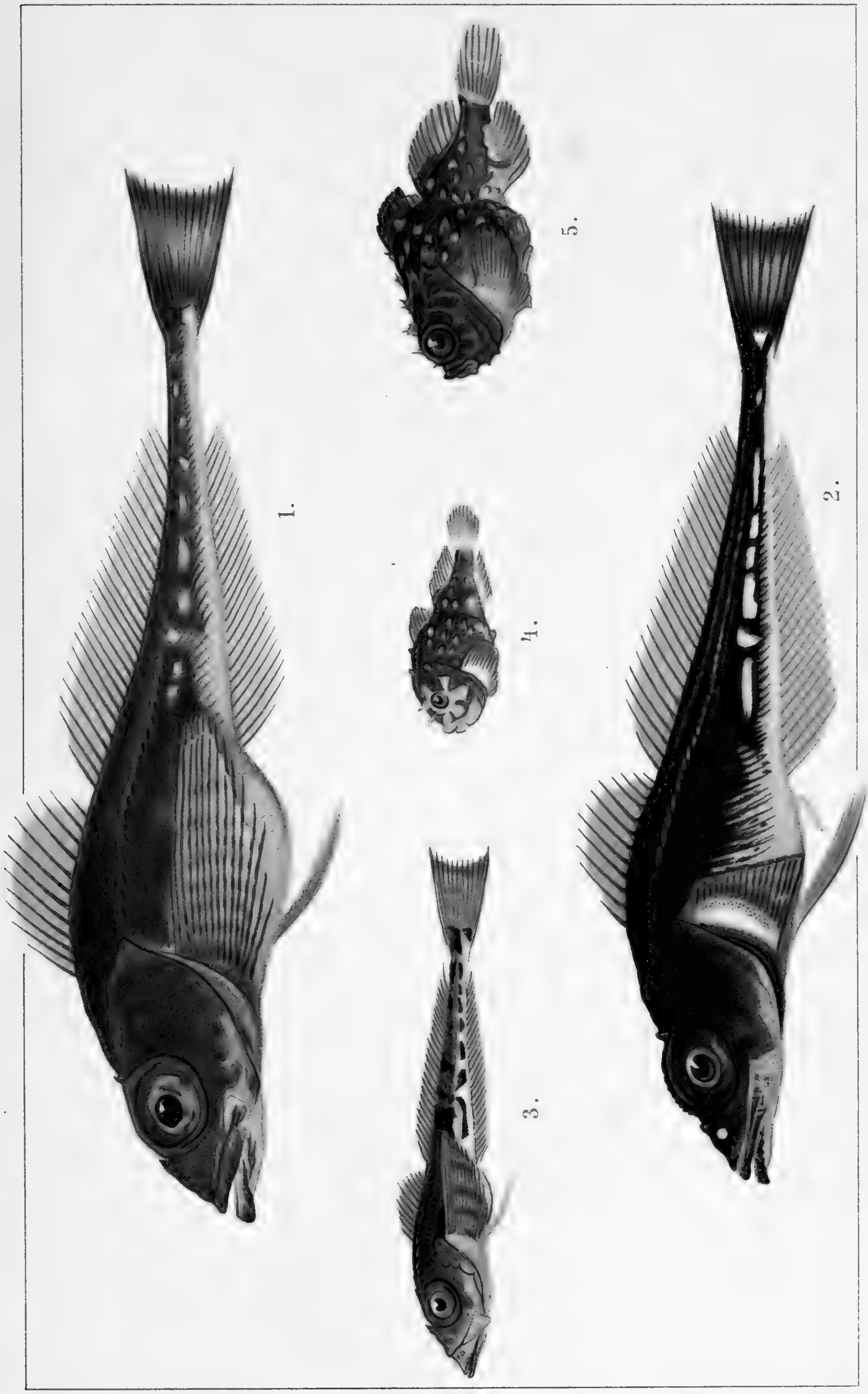


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Plate XLV.

PLATE XLV.

Fig. 1. *Gymnelis viridis.* 72 mm. $^{1}/_{1}$.
— 2. — — 117 mm. $^{1}/_{1}$.
— 3. — — 130 mm. $^{1}/_{1}$.
— 4. *Lycodes reticulatus.* 75 mm. $^{1}/_{1}$.
— 5. *Liparis liparis.* 42 mm. $^{2}/_{1}$.
— 6. *Salmo alpinus.* 80 mm. Ca. $^{1}/_{1}$.
— 7. — — 28 mm. $^{2}/_{1}$.
— 8. *Icelus hamatus.* 85 mm. $^{1}/_{1}$.
— 9. *Phobetor ventralis.* 64 mm. $^{1}/_{1}$.

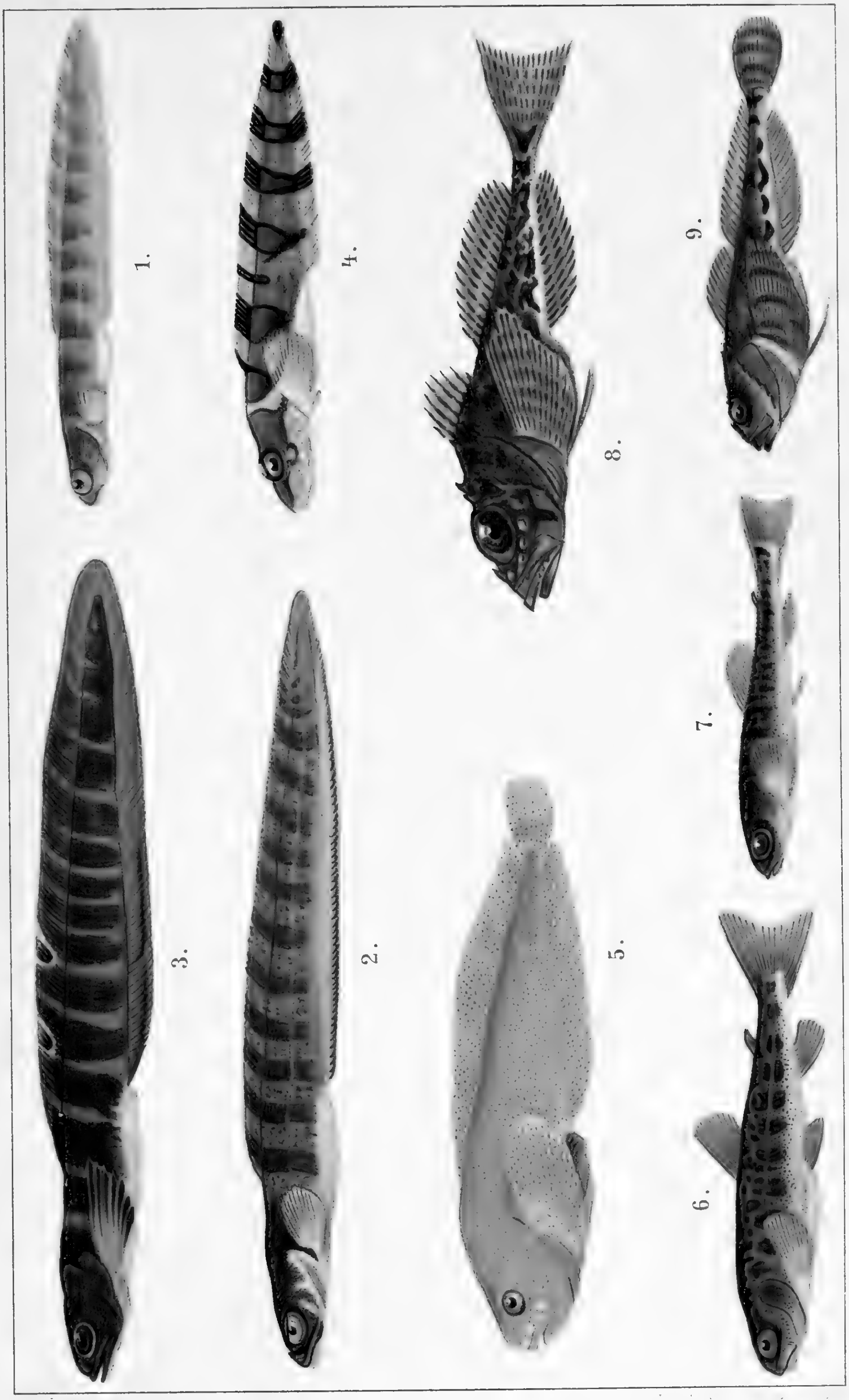
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Plate XLVI.

PLATE XLVI.

Fig. 1. *Liparis liparis.* 16 mm. $^4/_1$.
— 2. *Liparis fabricii.* 19 mm. $^2/_1$.
— 3. — — 49 mm. $^1/_1$.
— 4. — — 115 mm. $^1/_1$.
— 5. *Careproctus reinhardti.* 28 mm. $^2/_1$.
— 6. *Phobetor ventralis.* 25 mm. $^2/_1$.
— 7. — — 36 mm. $^2/_1$.
— 8. *Triglops pingelii.* 22,5 mm. $^2/_1$.
— 9. — — 50 mm. $^1/_1$.
— 10. *Icelus hamatus.* 33,5 mm. $^1/_1$.
— 11. *Cottus quadricornis.* 19 mm, youngest stage. $^3/_1$.
— 12. — — 19 mm, older — $^3/_1$.
— 13. — — 20 mm, oldest — $^3/_1$.

H. V. Westergaard del. *Pacht & Crone phototyp.*